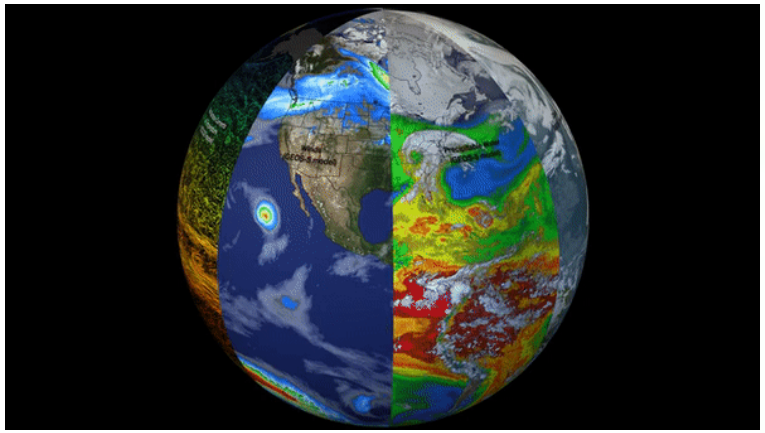


# Mashreq Water Data Portal Ecosystem

***Nagaraja Rao Harshadeep (Harsh)***

Global Lead (Disruptive Technology)

Environment, Natural Resources & Blue Economy Global Practice

Disruptive Technology

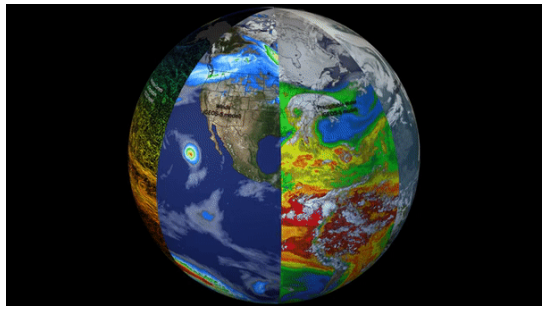
WORLD BANK GROUP

Disruptive KIDS (Knowledge, Information & Data Services) Helpdesk

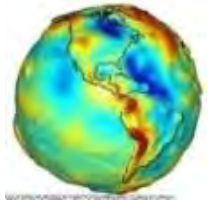
***Mashreq Water Knowledge Series***

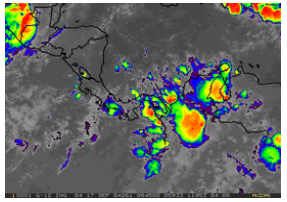
***Disruptive Technologies for Improved Groundwater Management in the Mashreq Region***

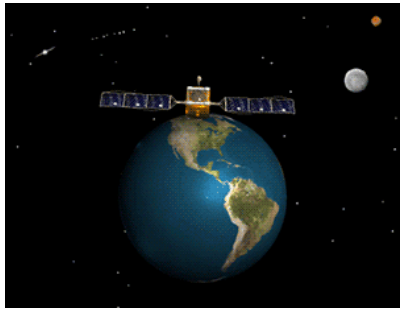
*15-17 June 2021*



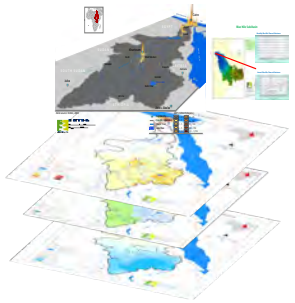
## "Top-Down" Data Acquisition System



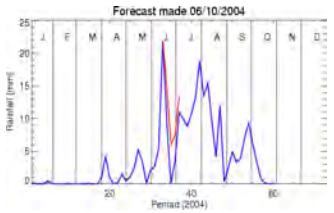




Satellite & Aerial Earth Observation



Data Rescue
GIS and other datasets




Data Management

Analytics/Models

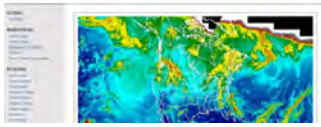
Big Data
Data Science

Platforms
APIs

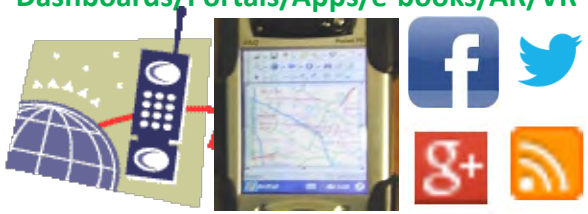
**Cloud Services**

Machine Learning
& other AI

ChatBots
Crowdsourcing



Dashboards/Portals/Apps/e-books/AR/VR



Stakeholder Alerts

Operational Control Rooms

Manual Monitoring
Crowdsourcing

Automated Monitoring

"Bottom-up" Data Acquisition System → IoT

# Mashreq Water Data Portal

https://spatialagent.org/Mashreq (also has links to Knowledge Explorer & E-Book)

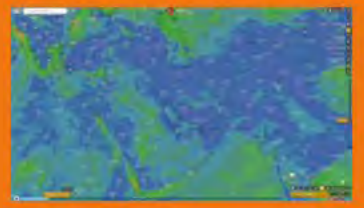
Mashreq Data Portal

## MASHREQ WATER RESOURCES PORTAL

All | Environmental | Social | Economic | Climate | Water | Disasters

Water Transition

Water Inventory


Windy

GEOGloWS Streamflow Explorer

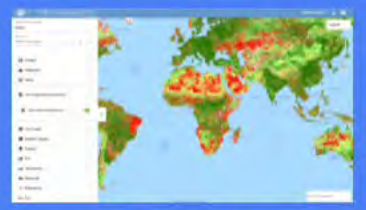
Power Plants

GRDC

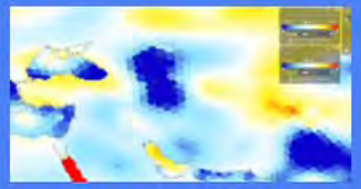
Watershed Delineation

NASA Disasters Portal

Earth Engine Water Watch


EarthMap (FAO)

Open Data Cube

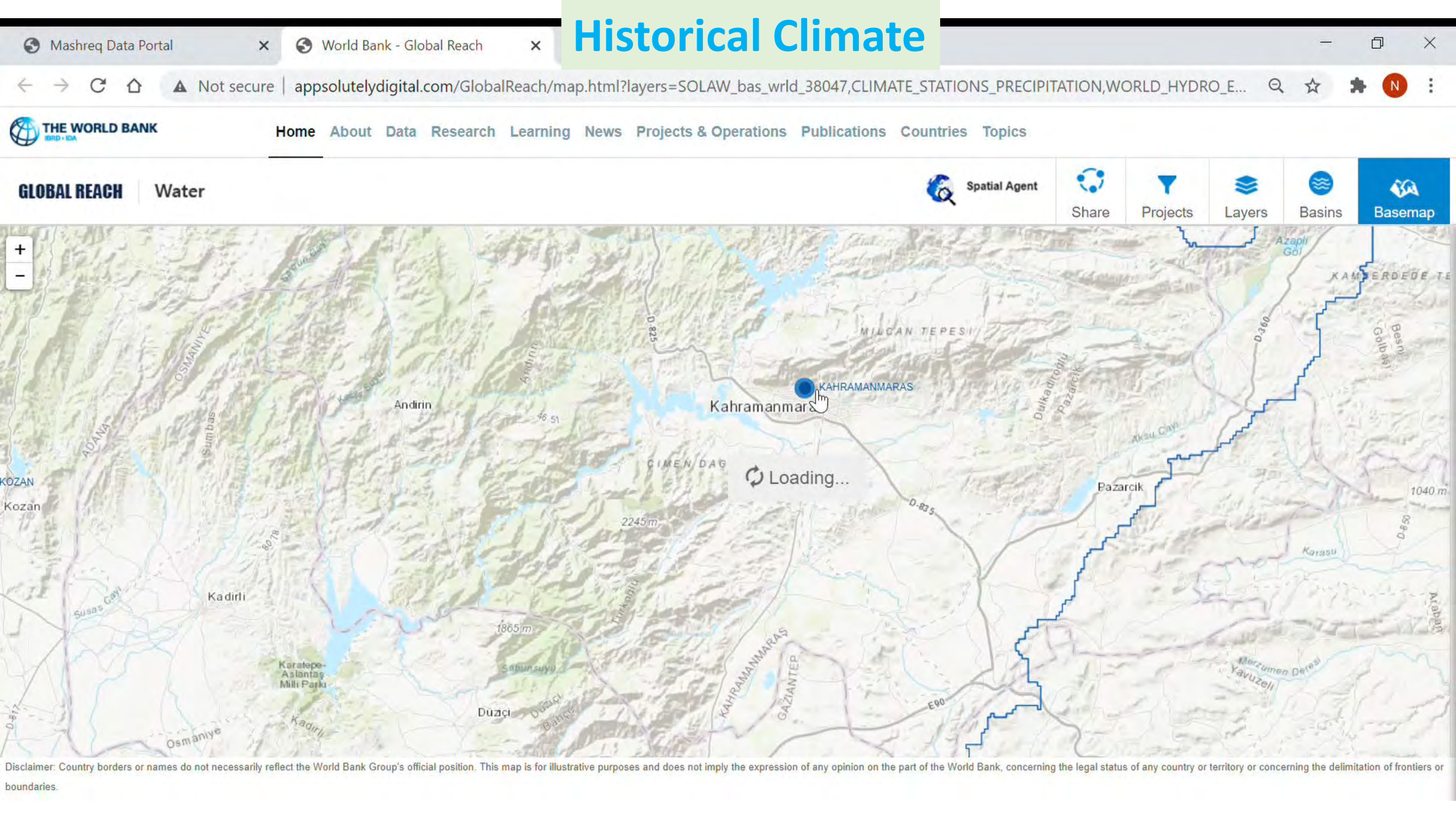

GRACE Groundwater

Lake Levels

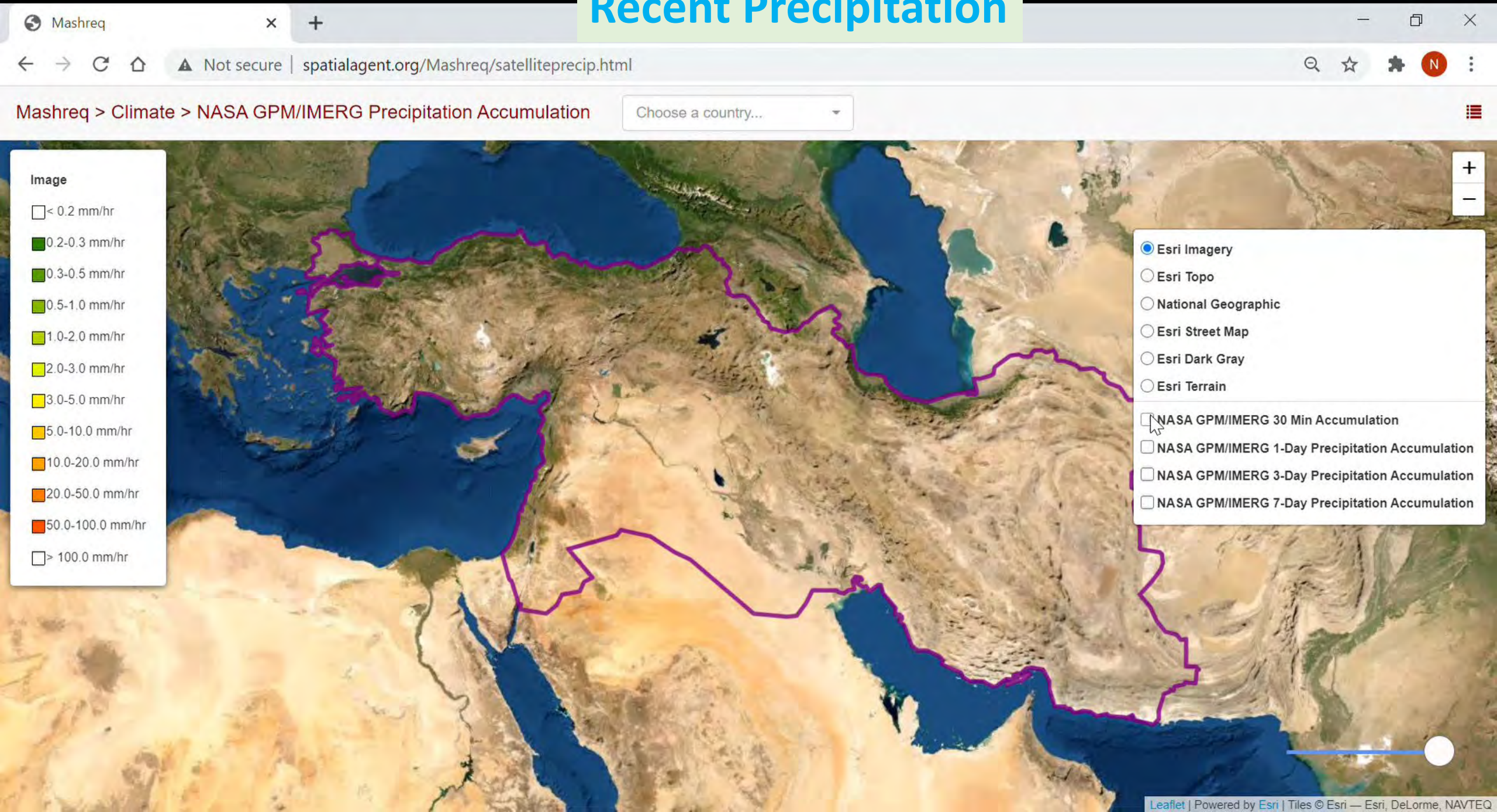
Climate Engine

MODIS Flood Explorer

# Historical Climate



# Recent Precipitation



# Real-time Weather

# Climate Change

Mashreq Data Portal | Home | RICCAR

climateknowledgeportal.worldbank.org/watershed/21/climate-data-projections

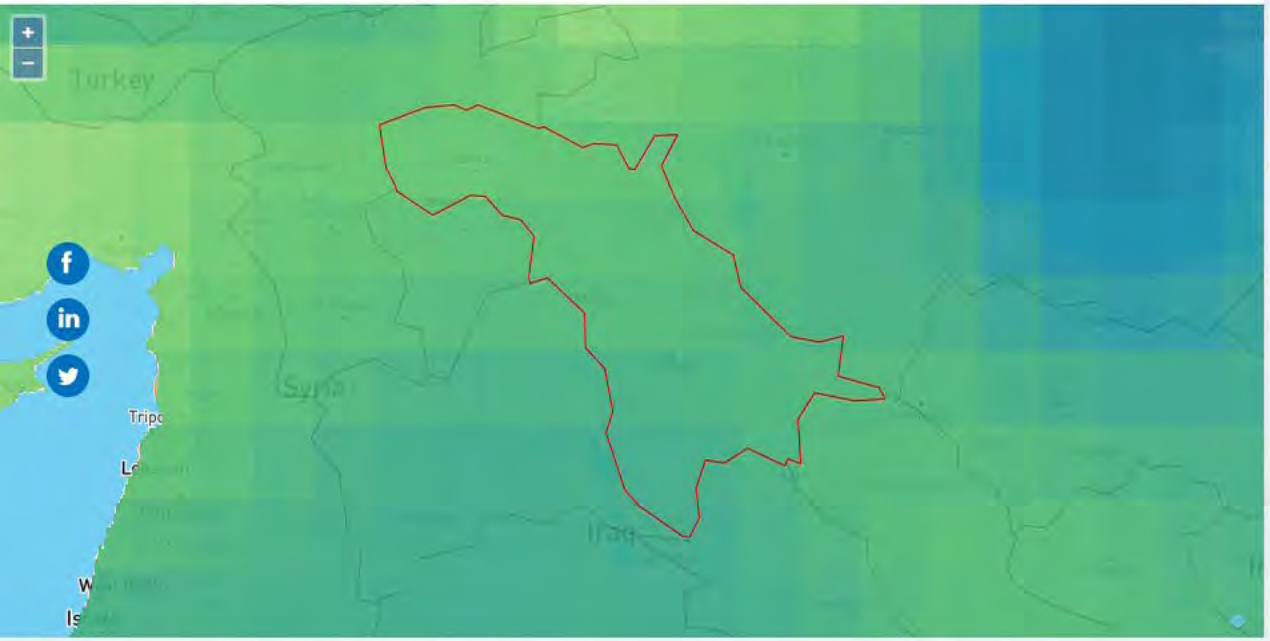
WORLD BANK GROUP | Climate Change Knowledge Portal
For Development Practitioners and Policy Makers

GLOSSARY METADATA CONTACT US

COUNTRY REGION WATERSHED DOWNLOAD DATA COUNTRY PROFILES AGRICULTURE PROFILES ABOUT TUTORIAL

| VARIABLE | TIME PERIOD | STATISTIC | SCENARIO | MODEL |
|---|---|---|---|---|
| Monthly Precipitation | 2080-2099 | Change (anomaly) | RCP 8.5 (High emission) | csiro_mk3_6_0 |

Projected Change in Monthly Precipitation of Watershed #21 for 2080-2099 (Compared to 1986-2005)

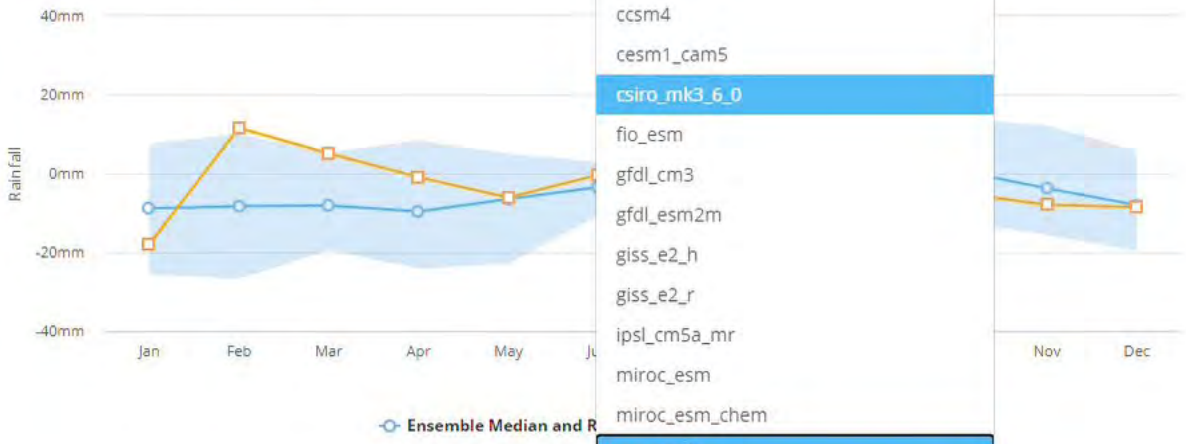



MONTHLY PRECIPITATION (MM)

-40 -30 -20 -10 -6 -2 0 2 6 10 20 30 40

METADATA

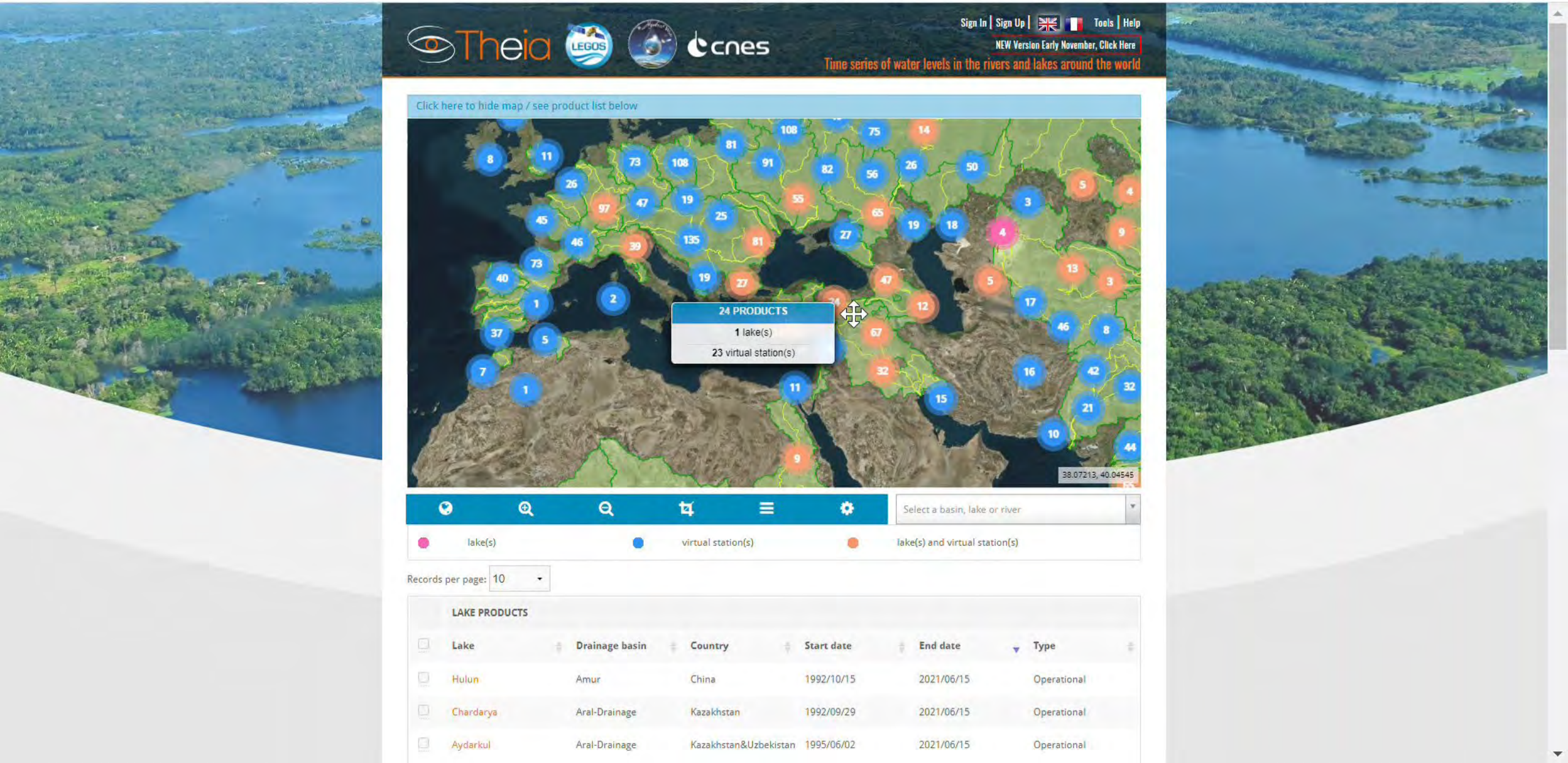
Projected Change in Monthly Precipitation for Watersl



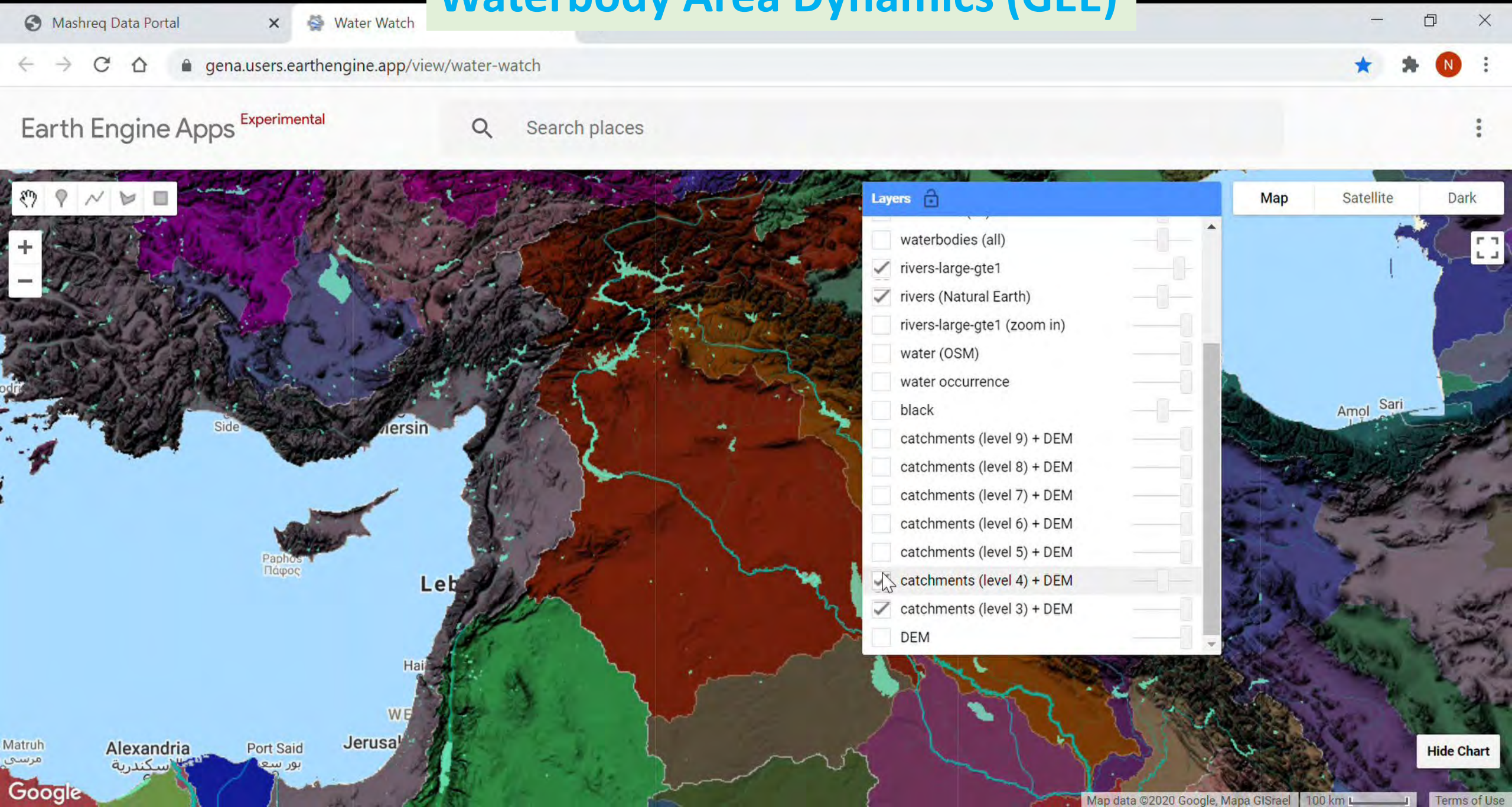

ensemble
bcc_csm1_1
bcc_csm1_1_m
ccsm4
cesm1_cam5
csiro_mk3_6_0
fio_esm
gfdl_cm3
gfdl_esm2m
giss_e2_h
giss_e2_r
ipsl_cm5a_mr
miroc_esm
miroc_esm_chem
mri_cgcm3
noresm1_m

Historical Observed Monthly Precipitation for Watersh

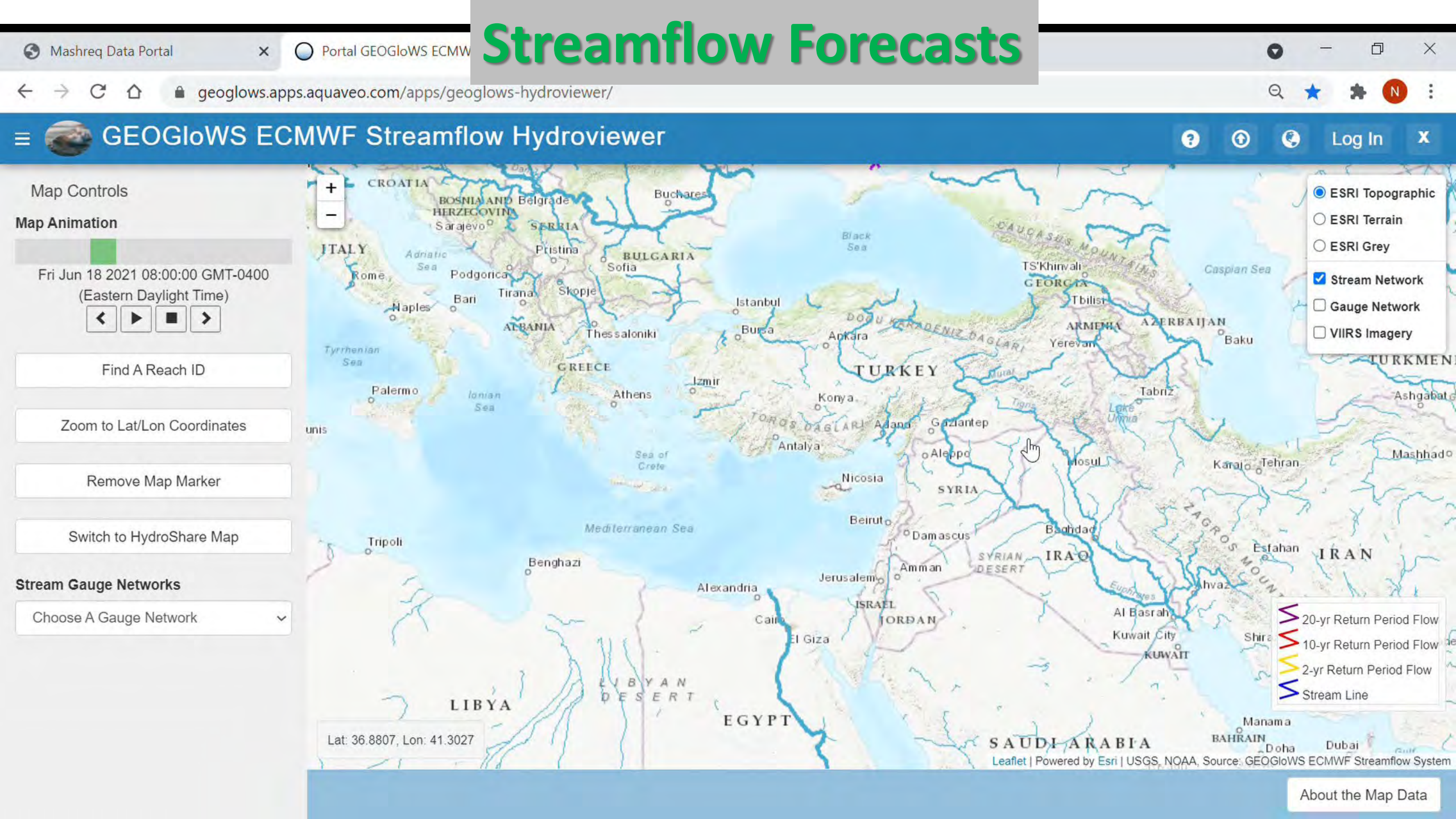
# Lake, Reservoir & River Levels



# Waterbody Area Dynamics (GEE)



# Streamflow Forecasts



# Historical Flows

Mashreq Data Portal | Portal GEOGloWS ECMWF Strea

geoglows.apps.aquaveo.com/apps/geoglows-hydroviewer/

Map Controls

Map Animation

Thu Jun 17 2021 (Eastern D

Find A

Zoom to Lat/l

Remove

Switch to Hy

Stream Gauge Netv

Choose A Gauge

Log In

ESRI Topographic

ESRI Terrain

ESRI Grey

Stream Network

Gauge Network

VIIRS Imagery

20-yr Return Period Flow

10-yr Return Period Flow

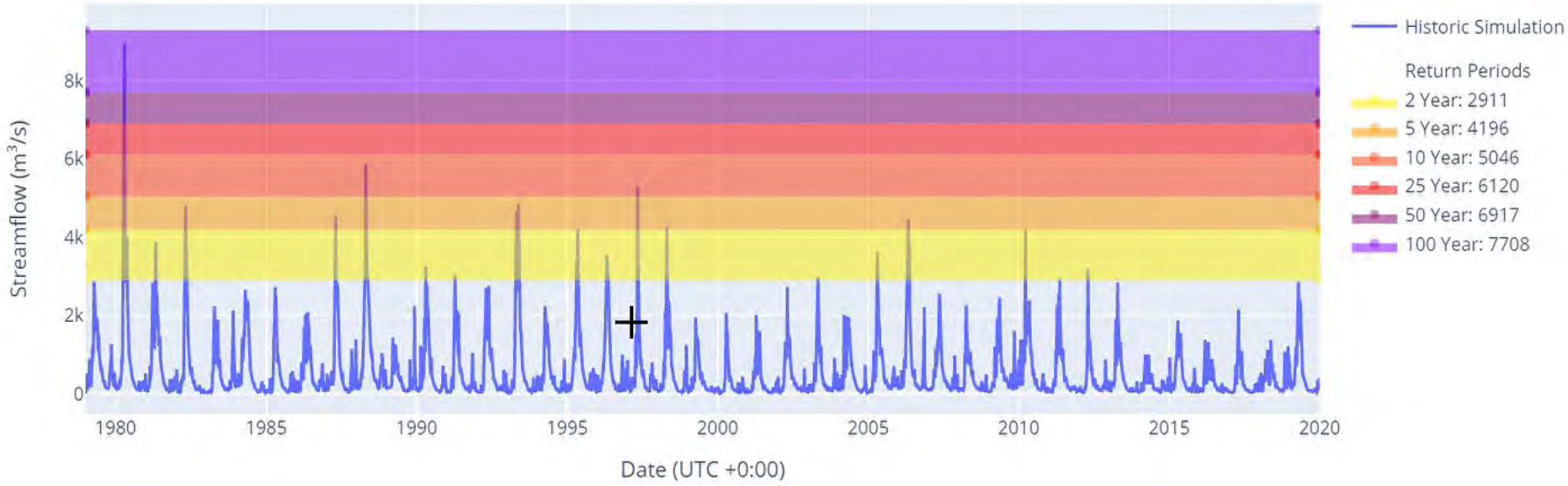
2-yr Return Period Flow

Stream Line

VS ECMWF Streamflow Syst

About the Map Data

Historic Streamflow Simulation
Reach ID: 606617

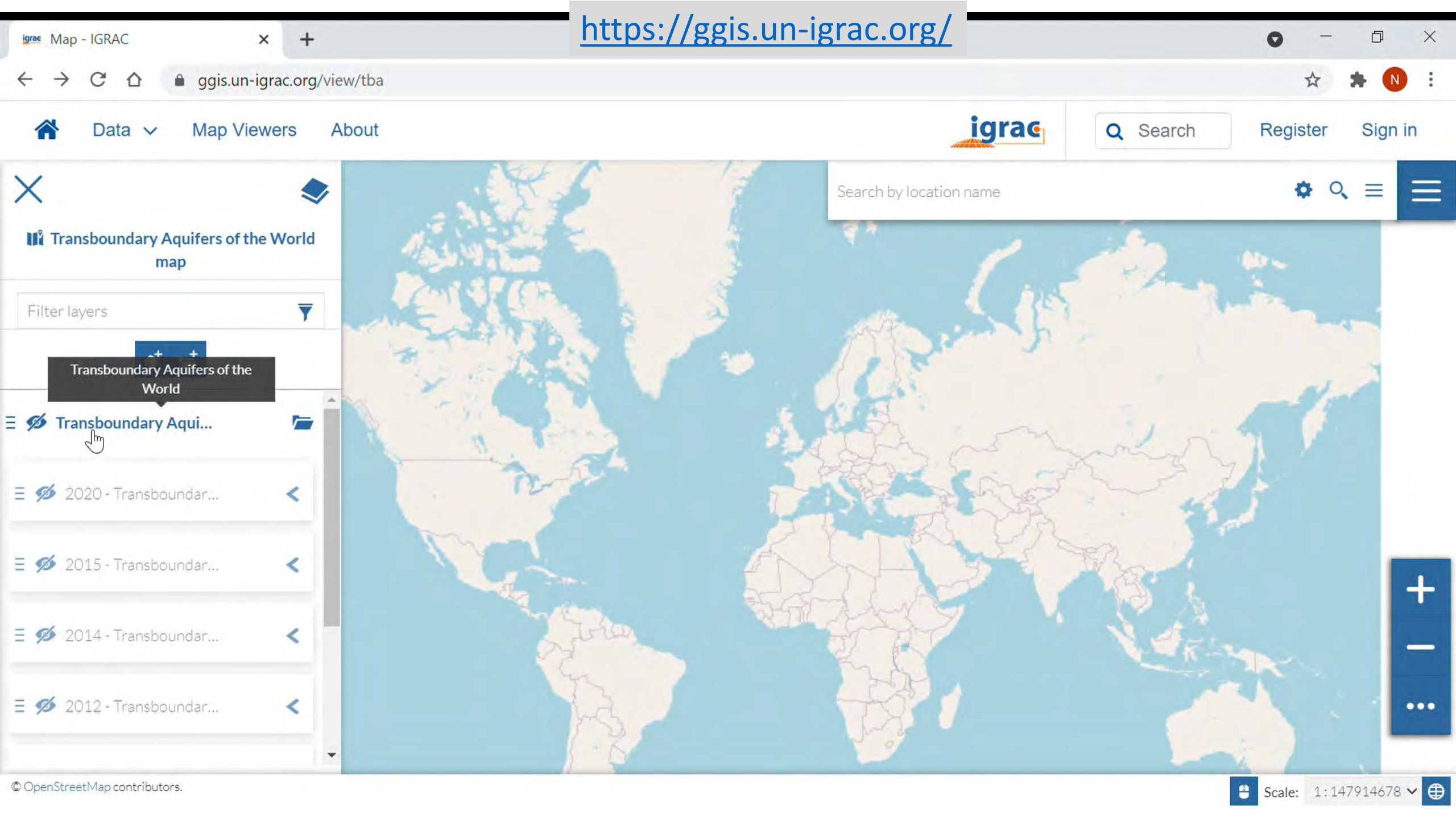



**Return Periods for Stream 606617.0 (m^3/s)**

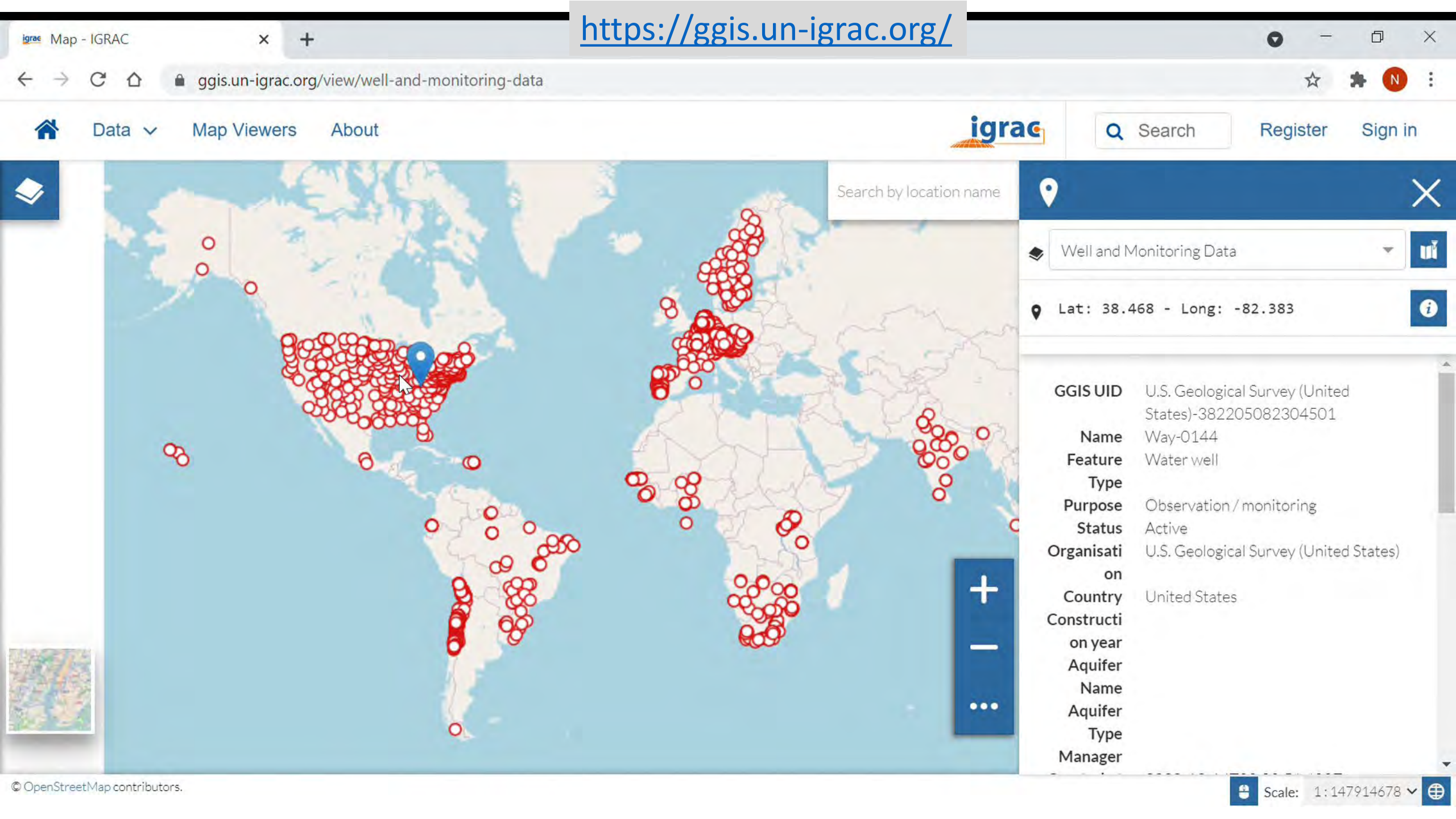
| 2 Year | 5 Year | 10 Year | 25 Year | 50 Year | 100 Year |
|---|---|---|---|---|---|
| 2911.92 | 4196.01 | 5046.18 | 6120.38 | 6917.28 | 7708.3 |

Download Historical Data | Resize the Chart | Close

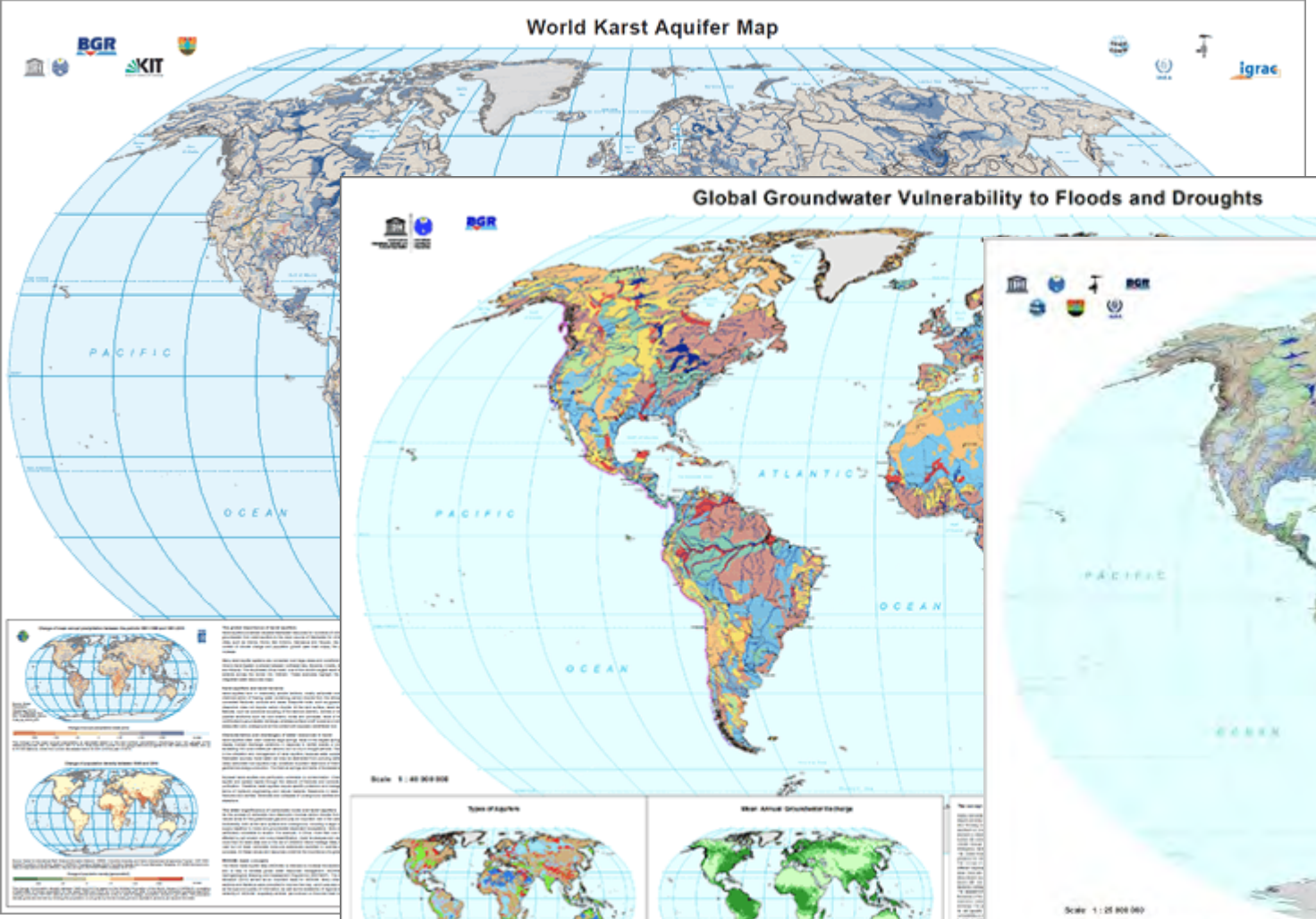
https://ggis.un-igrac.org/



https://ggis.un-igrac.org/

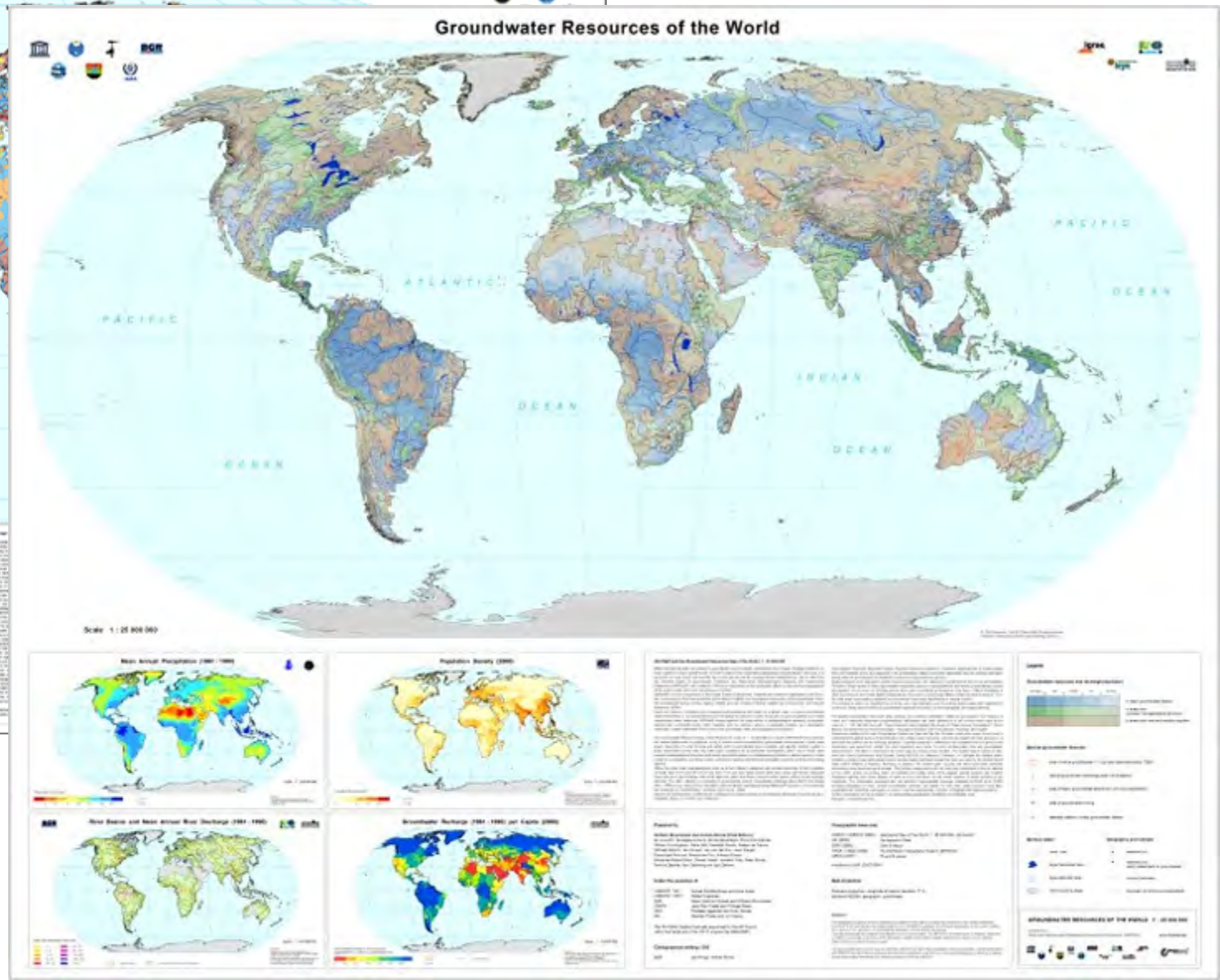


# BGR & UNESCO Groundwater Resources

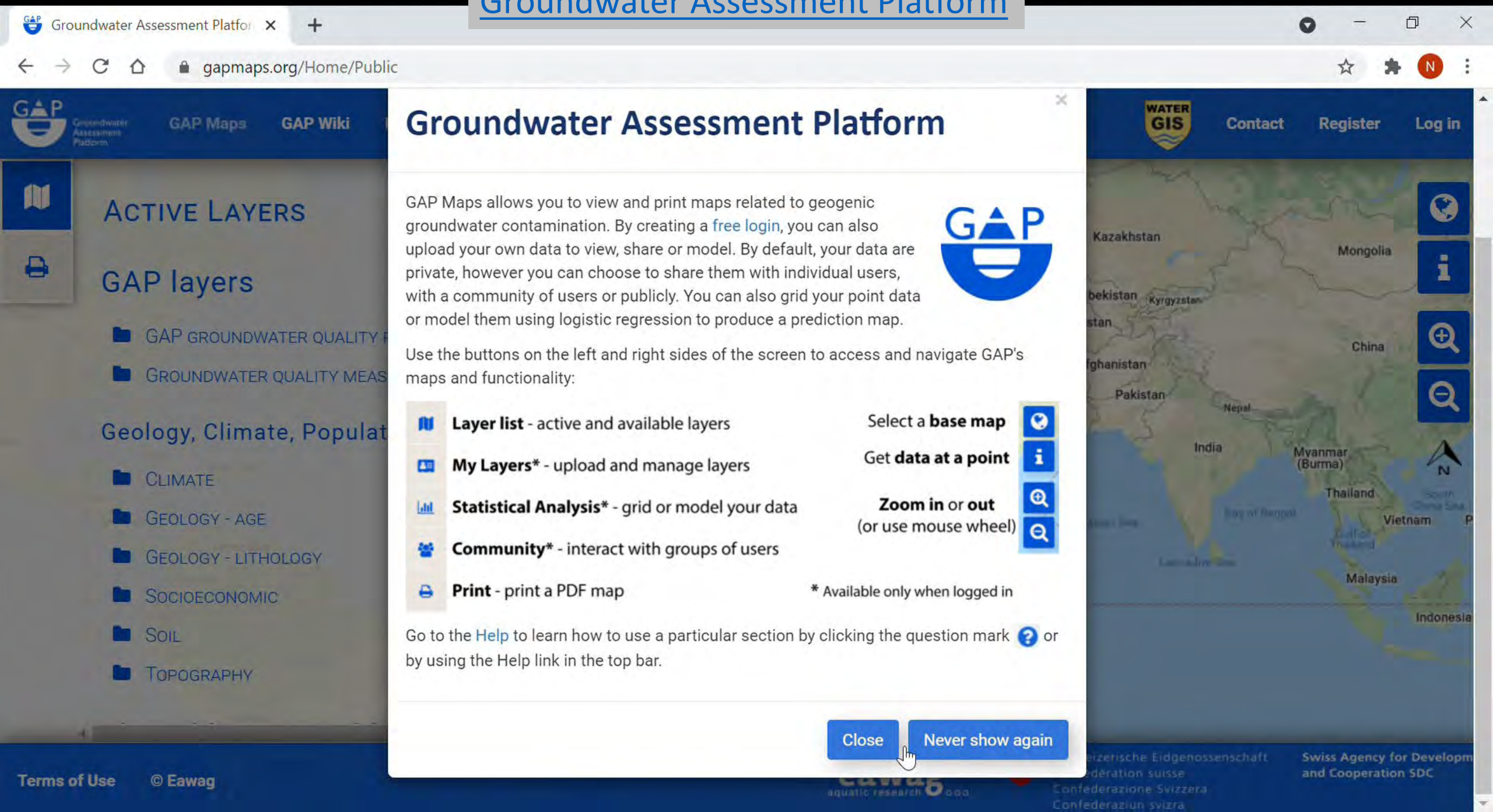








# Groundwater Assessment Platform



BYU Tethys Portal Groundwater L

tethys2.byu.edu/apps/gw/region_map/

# Groundwater Level Mapping Tool

Home

Regional Map

**Select Region**

Texas

**Select Aquifer**

**Select Data Type**

Depth to Groundwater

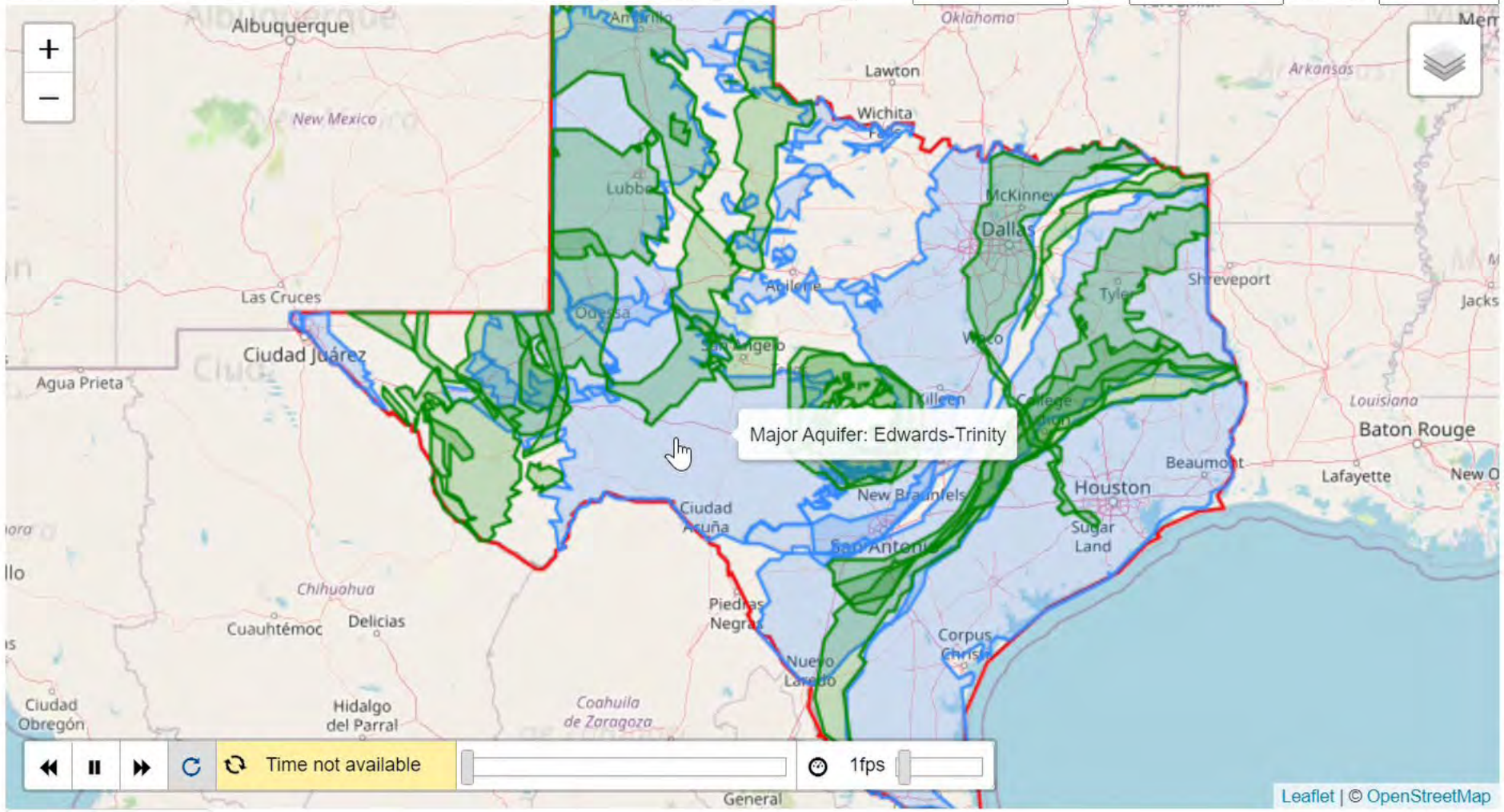
**Available Raster Animations**

**Minimum Samples per Well**

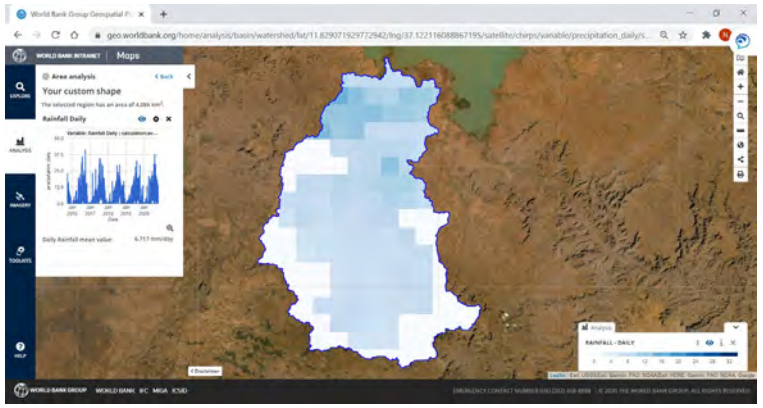
5

Map Height: 500 pixels

Select Symbology: GRACE Min: -500 Max: 0 Opacity: 0.7

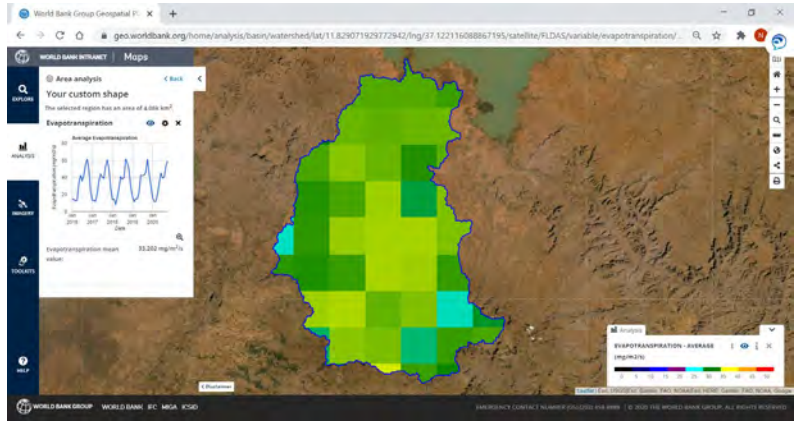



Region Home

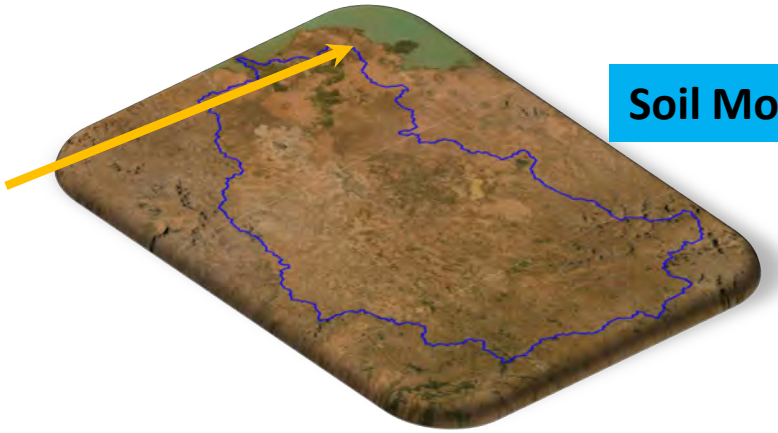


Precipitation

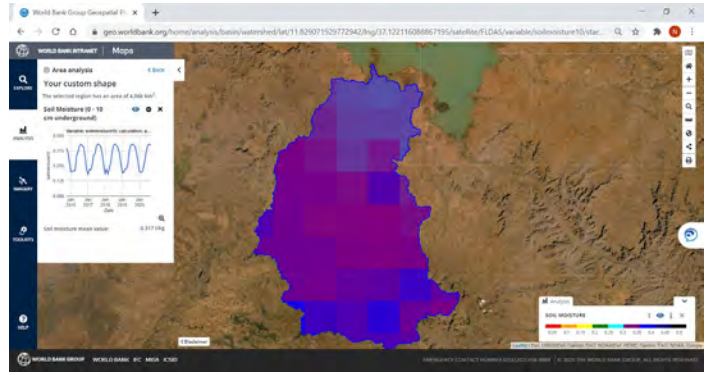
Evapotranspiration

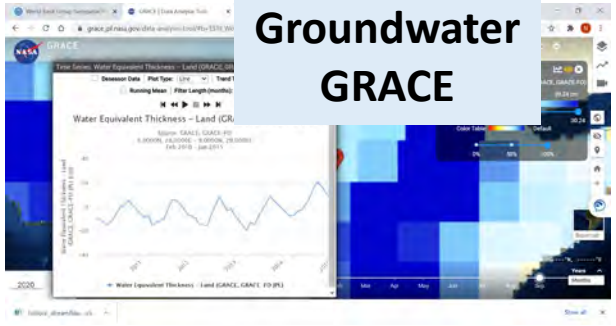


Streamflow



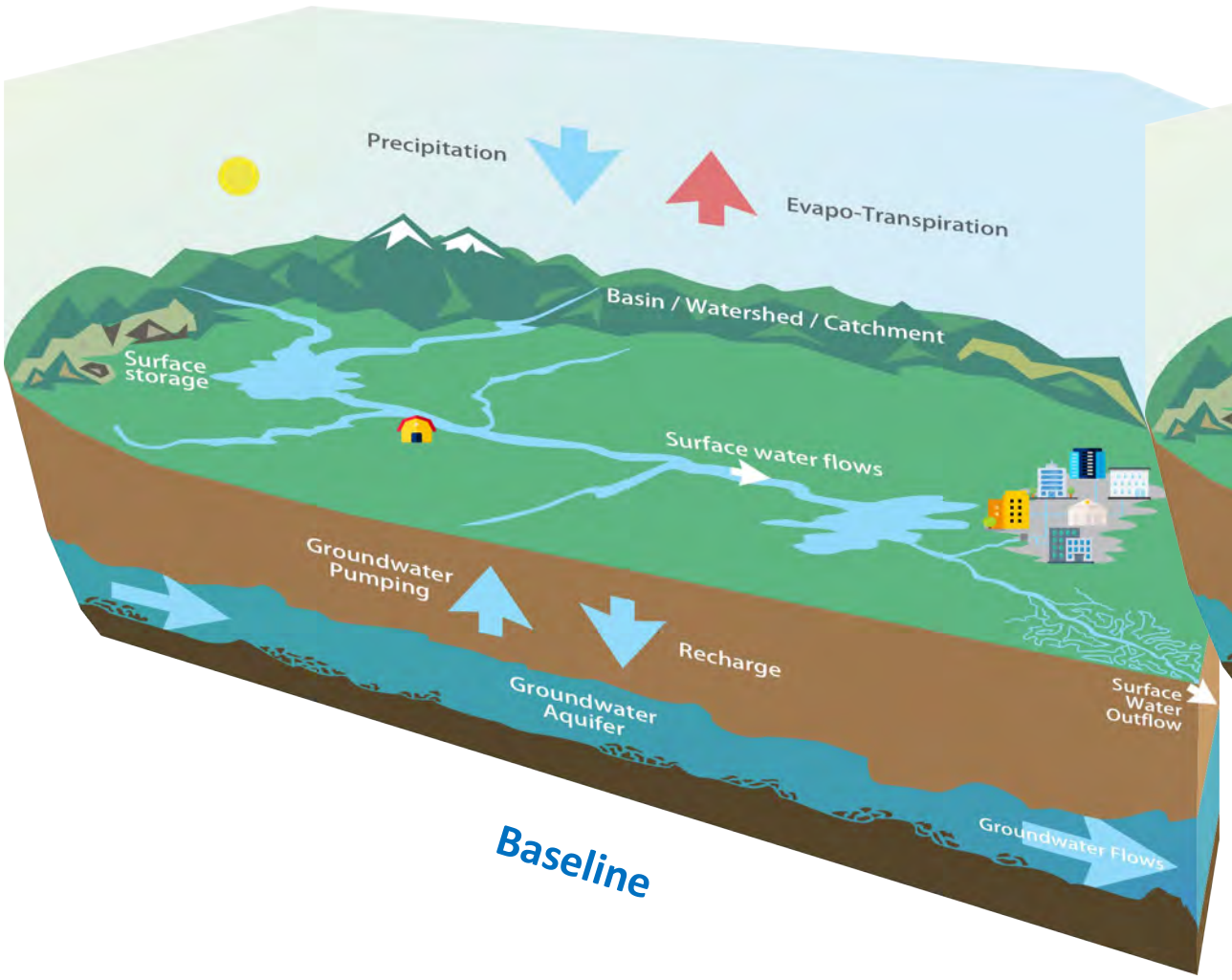
Soil Moisture



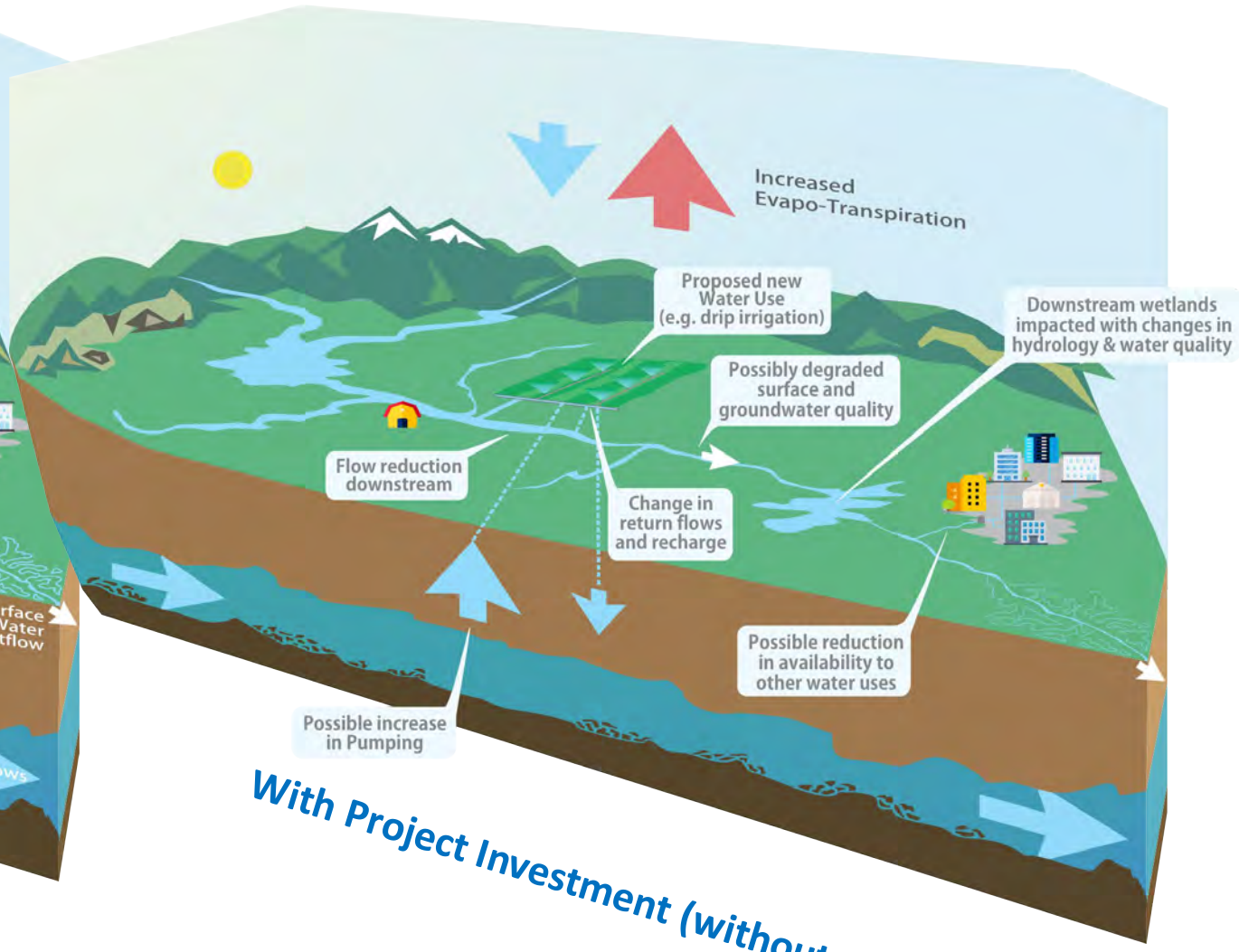


Groundwater
GRACE

# Water Use & Balance in a Systems Context

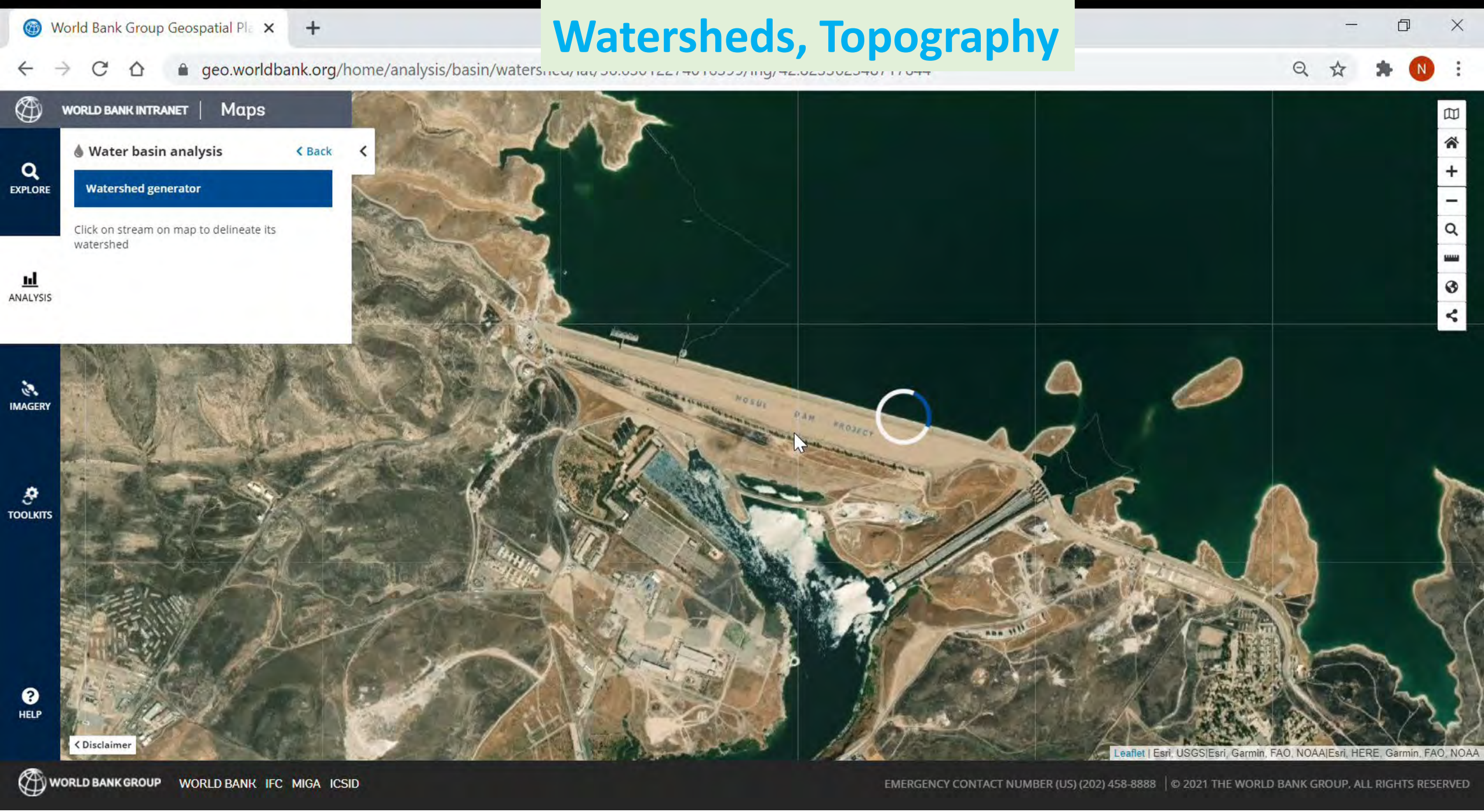



Baseline

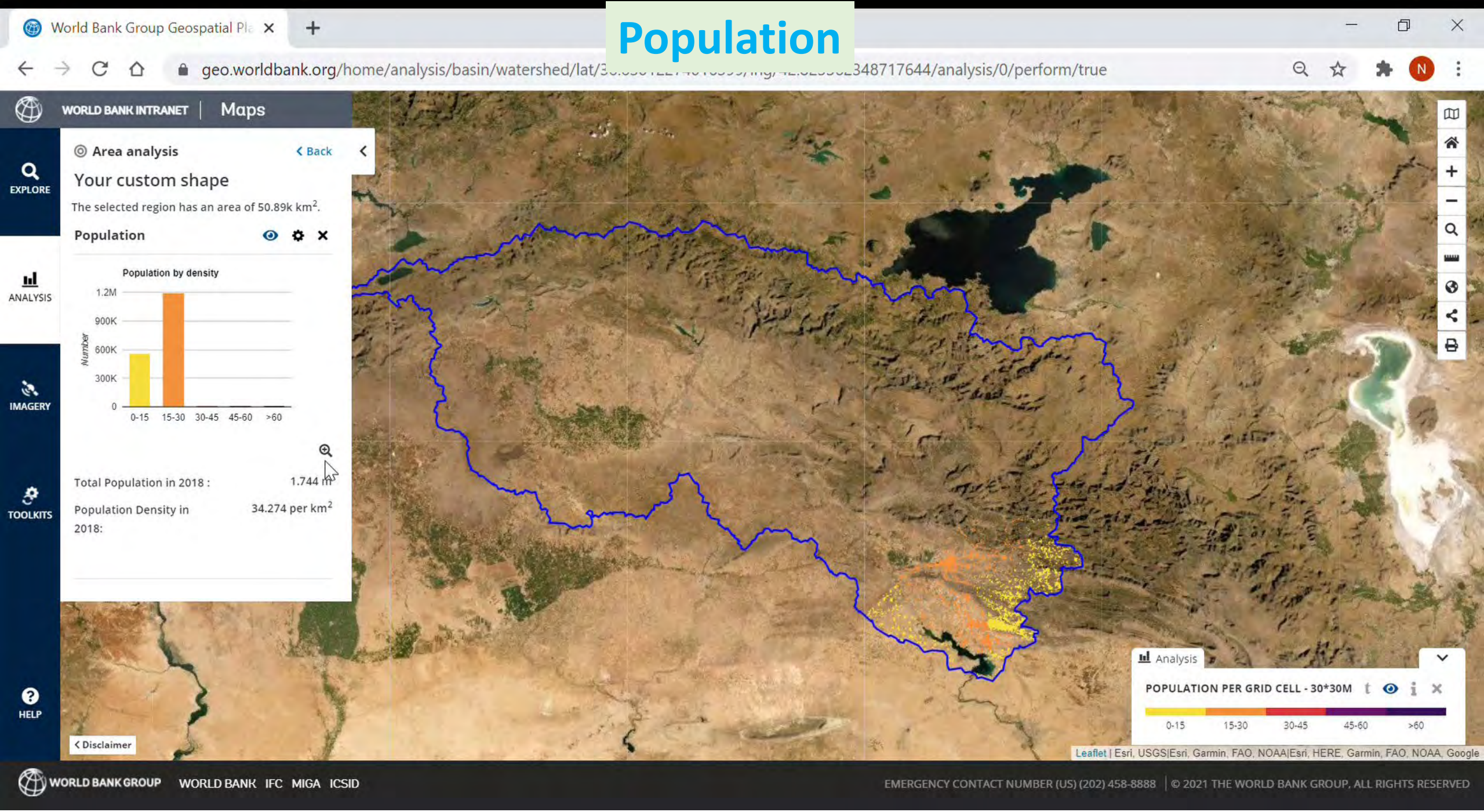



With Project Investment (without mitigation)

# Watersheds, Topography



# Population


World Bank Group Geospatial Pla
geo.worldbank.org/home/analysis/basin/watershed/lat/
348717644/analysis/0/perform/true
WORLD BANK INTRANET | Maps
EXPLORE
ANALYSIS
IMAGERY
TOOLKITS
HELP
Area analysis
Back
Your custom shape
The selected region has an area of 50.89k km².
Population
Population by density
1.2M
900K
600K
300K
0
Number
0-15
15-30
30-45
45-60
>60
Total Population in 2018 :
1.744 m
Population Density in 2018:
34.274 per km²
Disclaimer
Analysis
POPULATION PER GRID CELL - 30*30M
0-15
15-30
30-45
45-60
>60
Leaflet | Esri, USGS|Esri, Garmin, FAO, NOAA|Esri, HERE, Garmin, FAO, NOAA, Google
WORLD BANK GROUP
WORLD BANK IFC MIGA ICSID
EMERGENCY CONTACT NUMBER (US) (202) 458-8888
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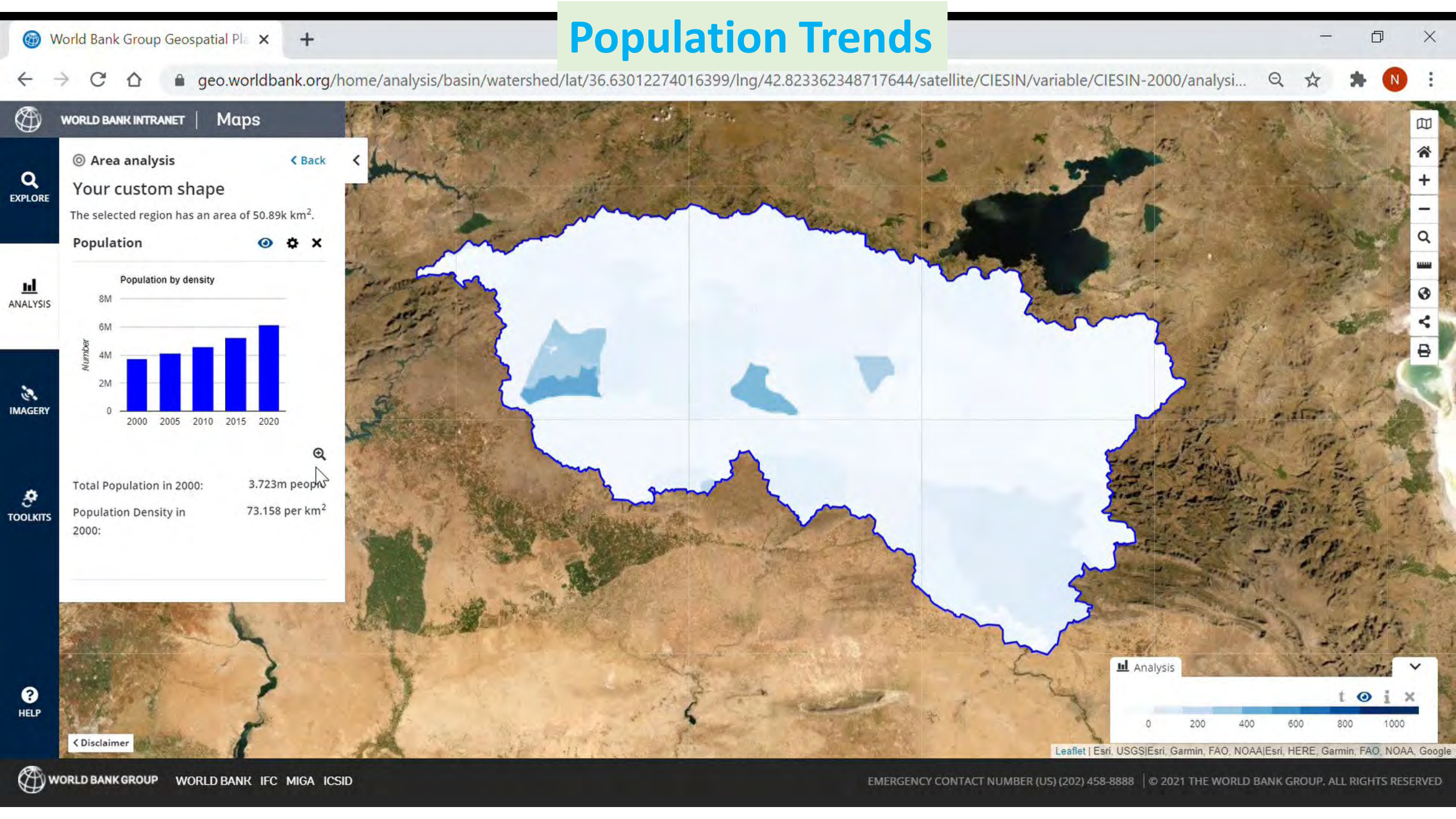
# Population Trends



# Rainfall

Mashreq Data Portal | World Bank Group Geospatial Pla

geo.worldbank.org/home/analysis/shape/param1/Polygon/param2/%5B%5B47.010498,31.43189%5D,%5B46.889648,30.966416%5D,%5B46.367798,...

WORLD BANK INTRANET | Maps

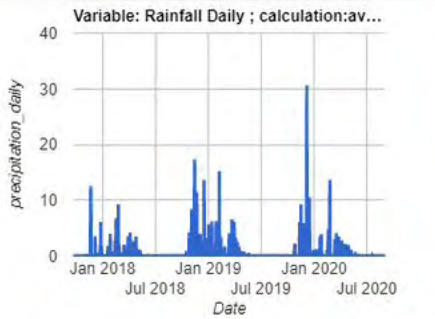
EXPLORE
ANALYSIS
IMAGERY
TOOLKITS
HELP

Area analysis < Back

## Your custom shape

The selected region has an area of 2.93k km$^2$.

**Rainfall Daily**




Daily Rainfall mean value: 1.829 mm/day

Analysis

RAINFALL - DAILY

0 4 8 12 16 20 24 28 32

< Disclaimer

Leaflet | Esri, USGS|Esri, Garmin, FAO, NOAA|Esri, HERE, Garmin, FAO, NOAA

WORLD BANK GROUP WORLD BANK IFC MIGA ICSID

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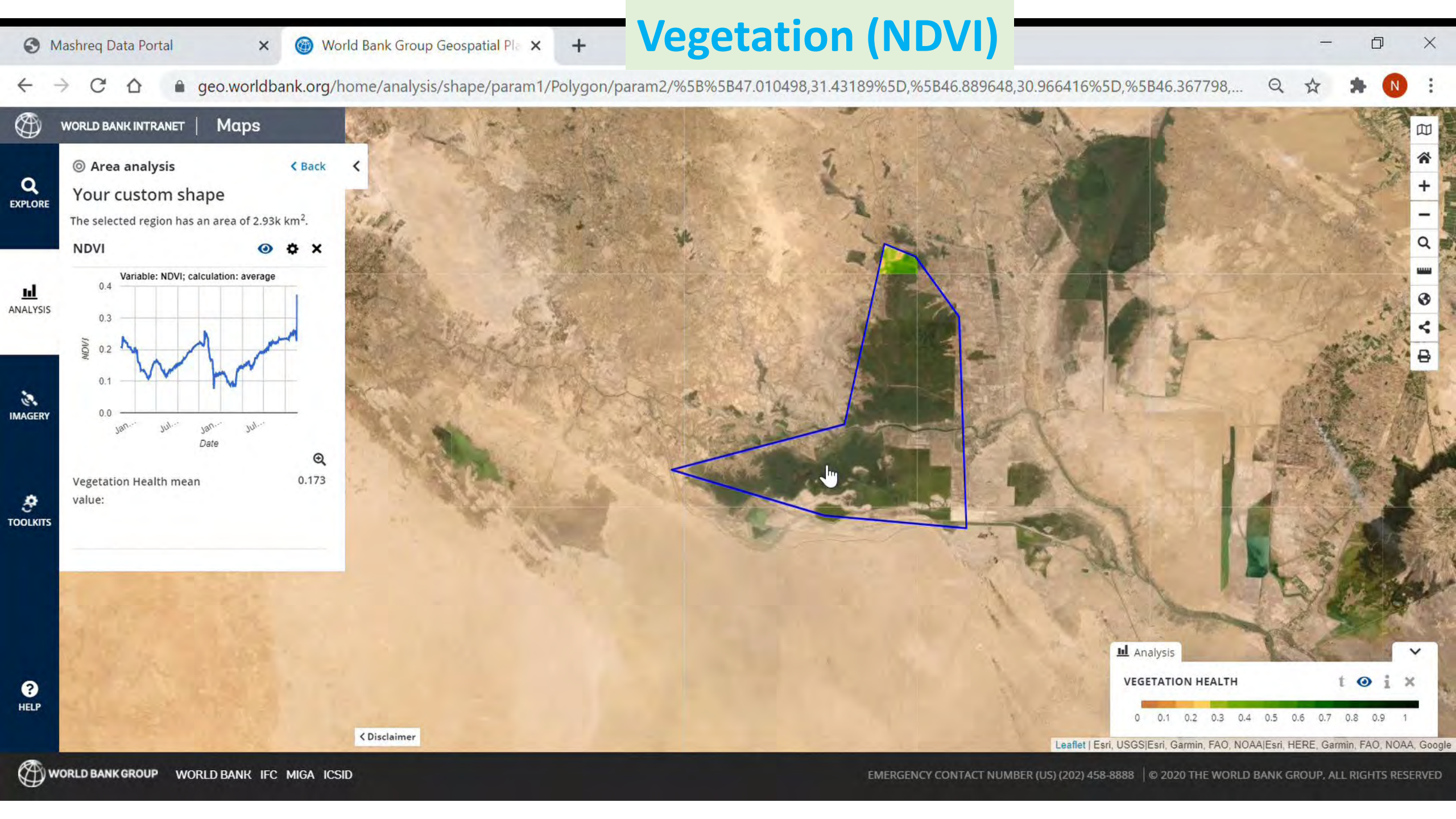
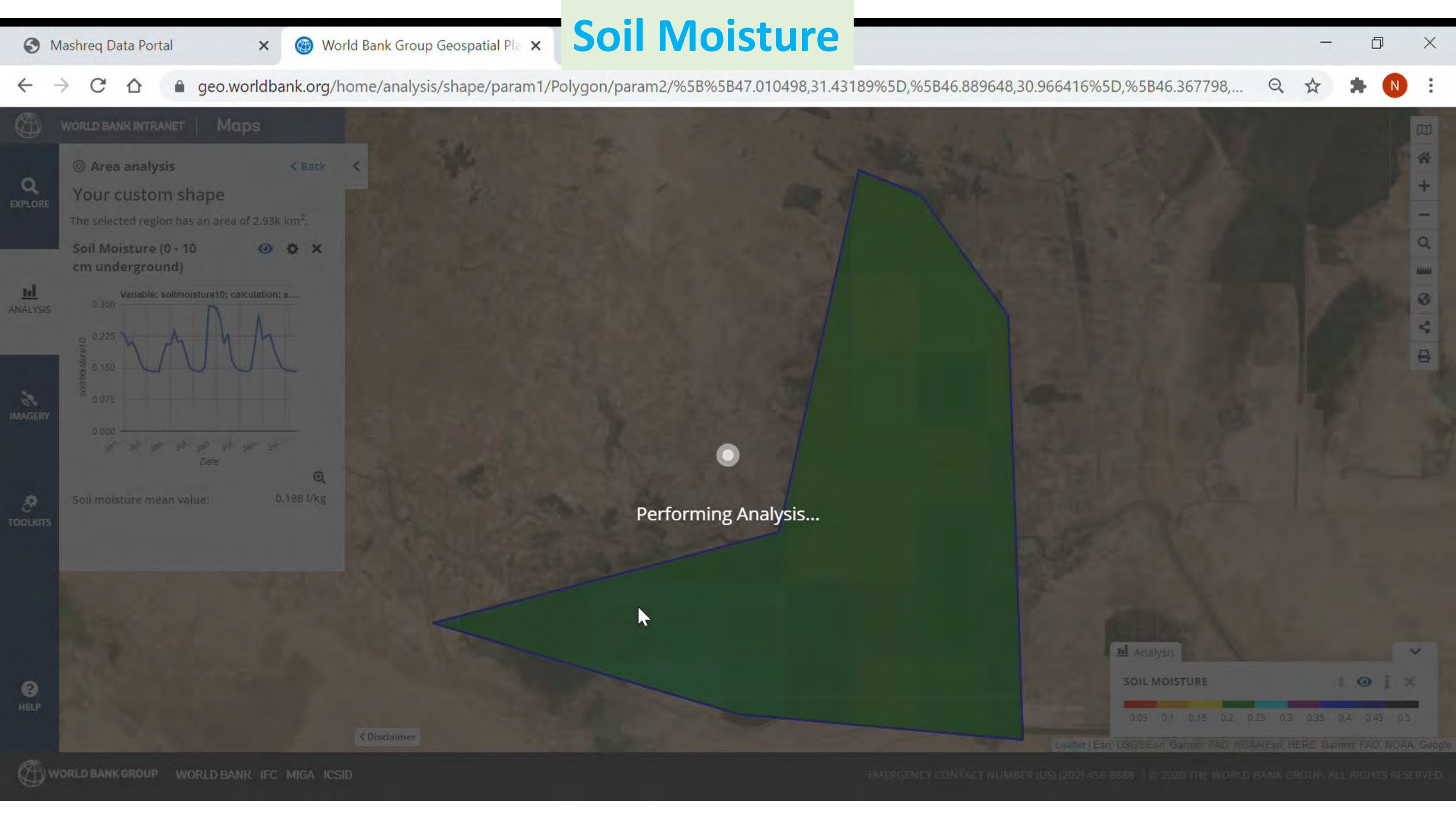
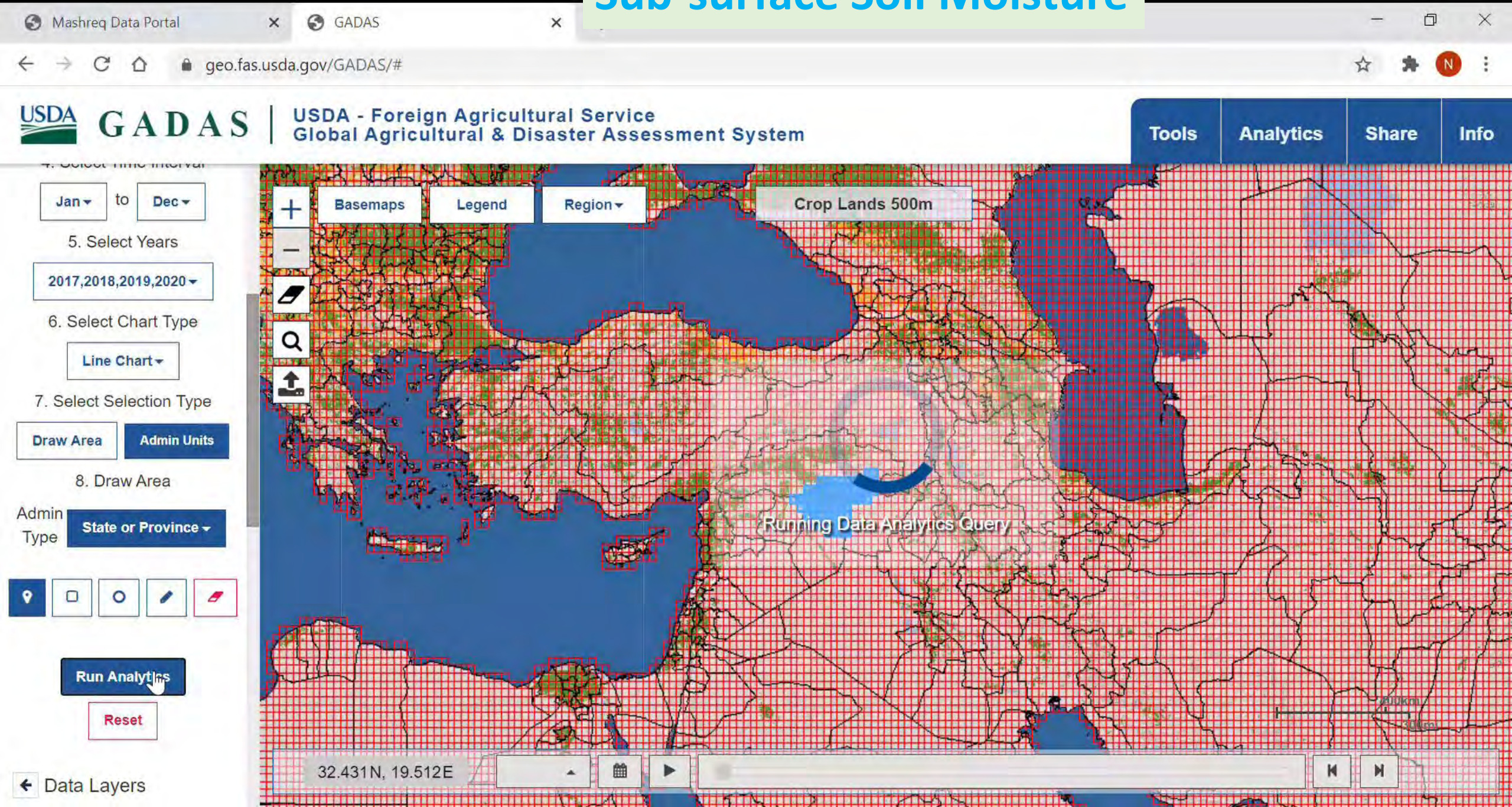
# Vegetation (NDVI)



# Soil Moisture



# Sub-surface Soil Moisture



# Evapo-Transpiration

Mashreq Data Portal | https://app.climateengine.org/cl

app.climateengine.org/climateEngine

Make Map | Make Graph | INFO

GET TIME SERIES

**Time Series Calculation:**
Native Time Series
One Variable Analysis

**Region:**
Polygon
Add another region

Variable 1

**Variable 1**
Type: Remote Sensing
Dataset: USGS MODIS ET - SSEBop Dekadal
Variable: Evapotranspiration (ETa)
Units: millimeters

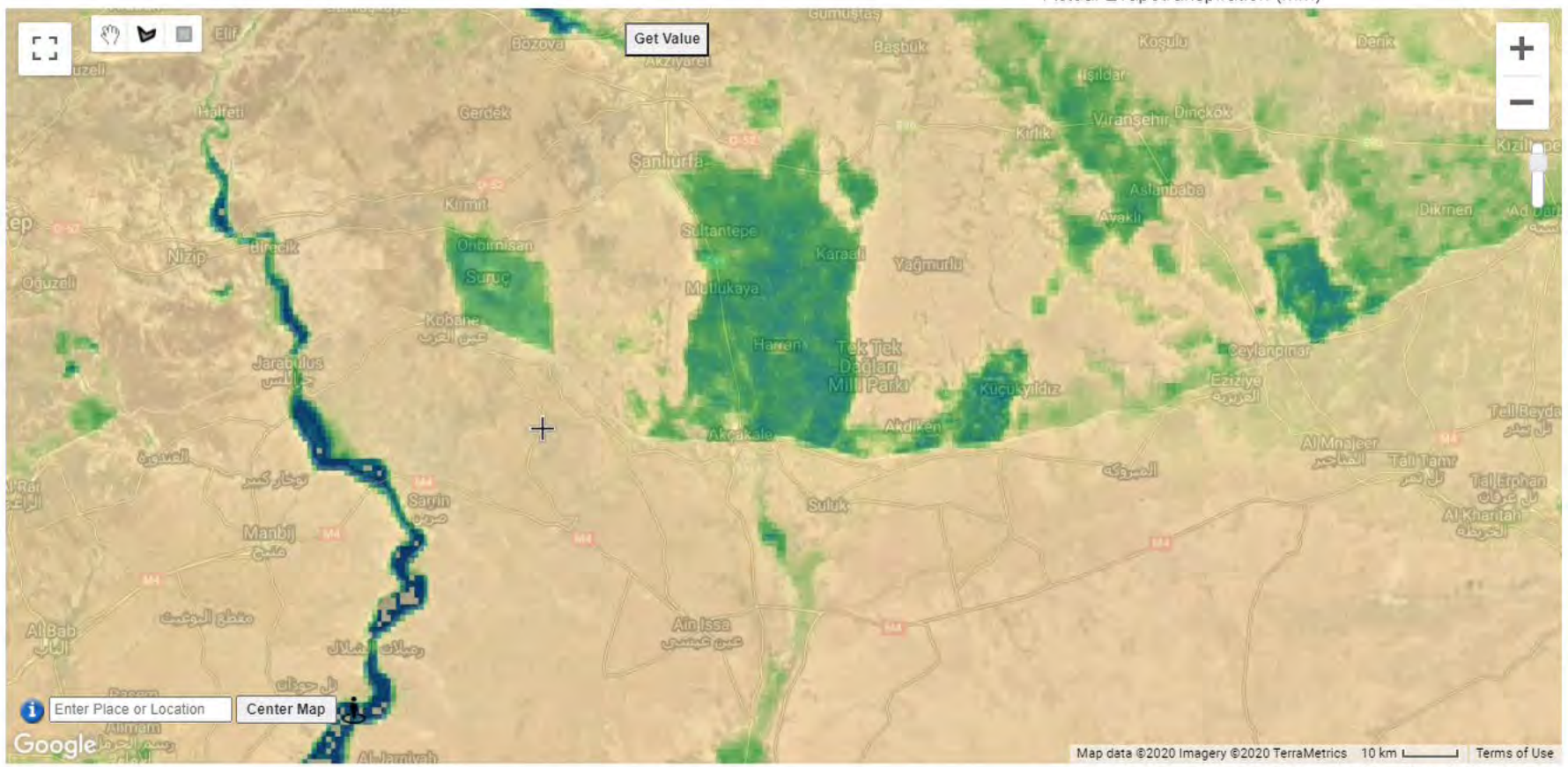
**Computation**
Resolution (Scale): 1000 m (1/96-deg)

MENU | Map

Climate Engine

2019-11-02 to 2020-11-01, Total

0.0 | 500 | 1,000 | 1,500
Actual Evapotranspiration (mm)

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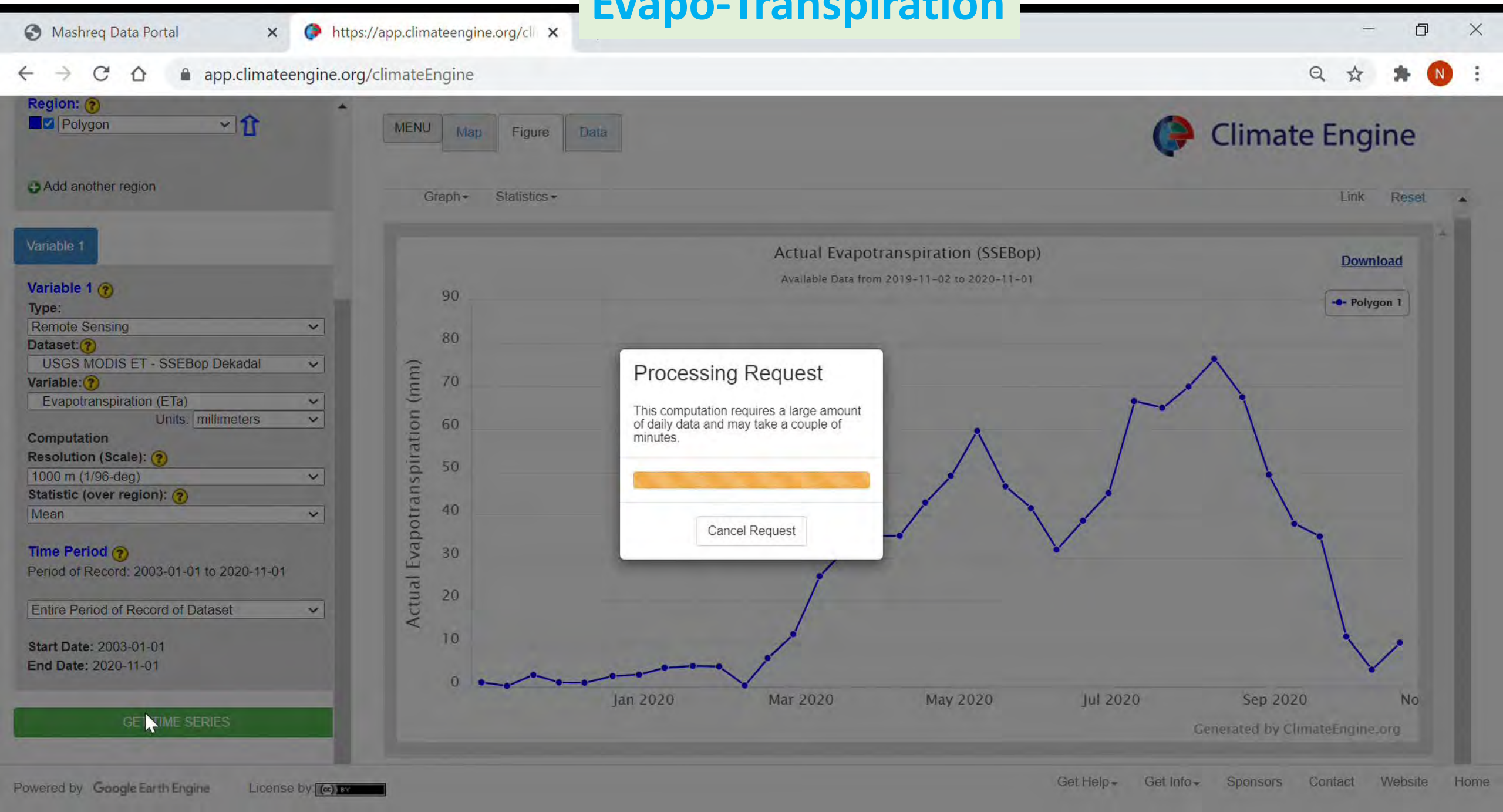
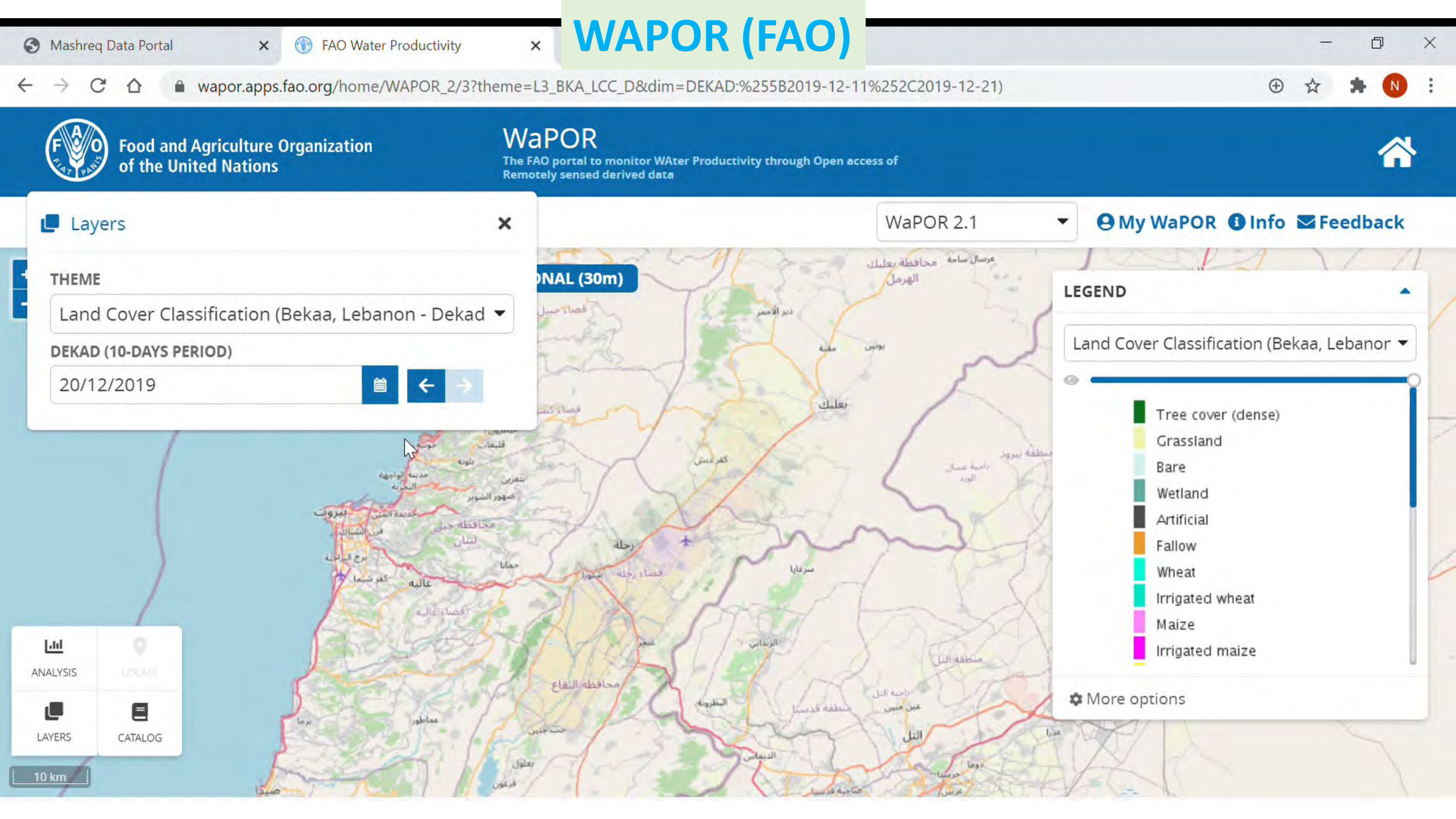
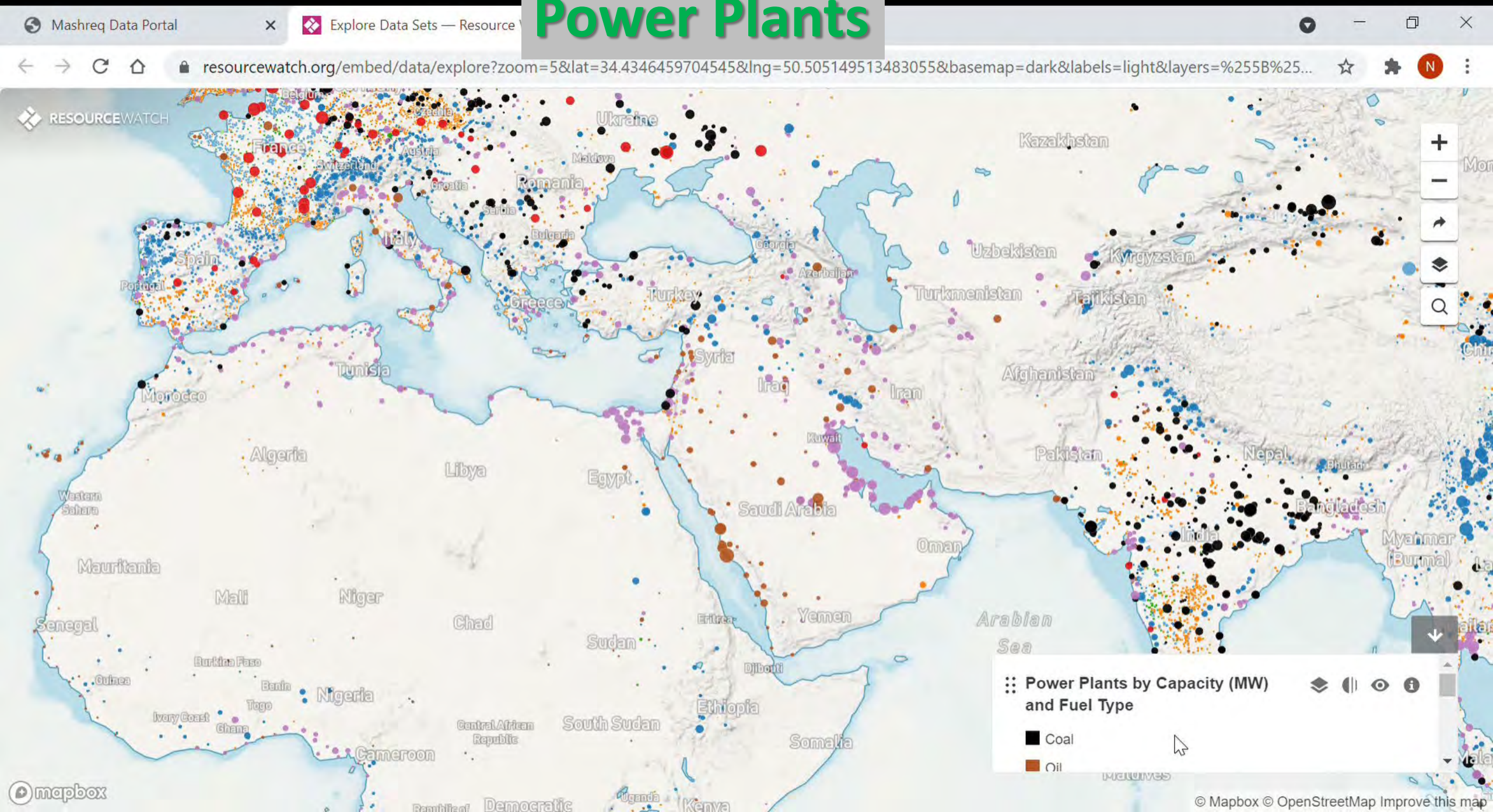
# Evapo-Transpiration



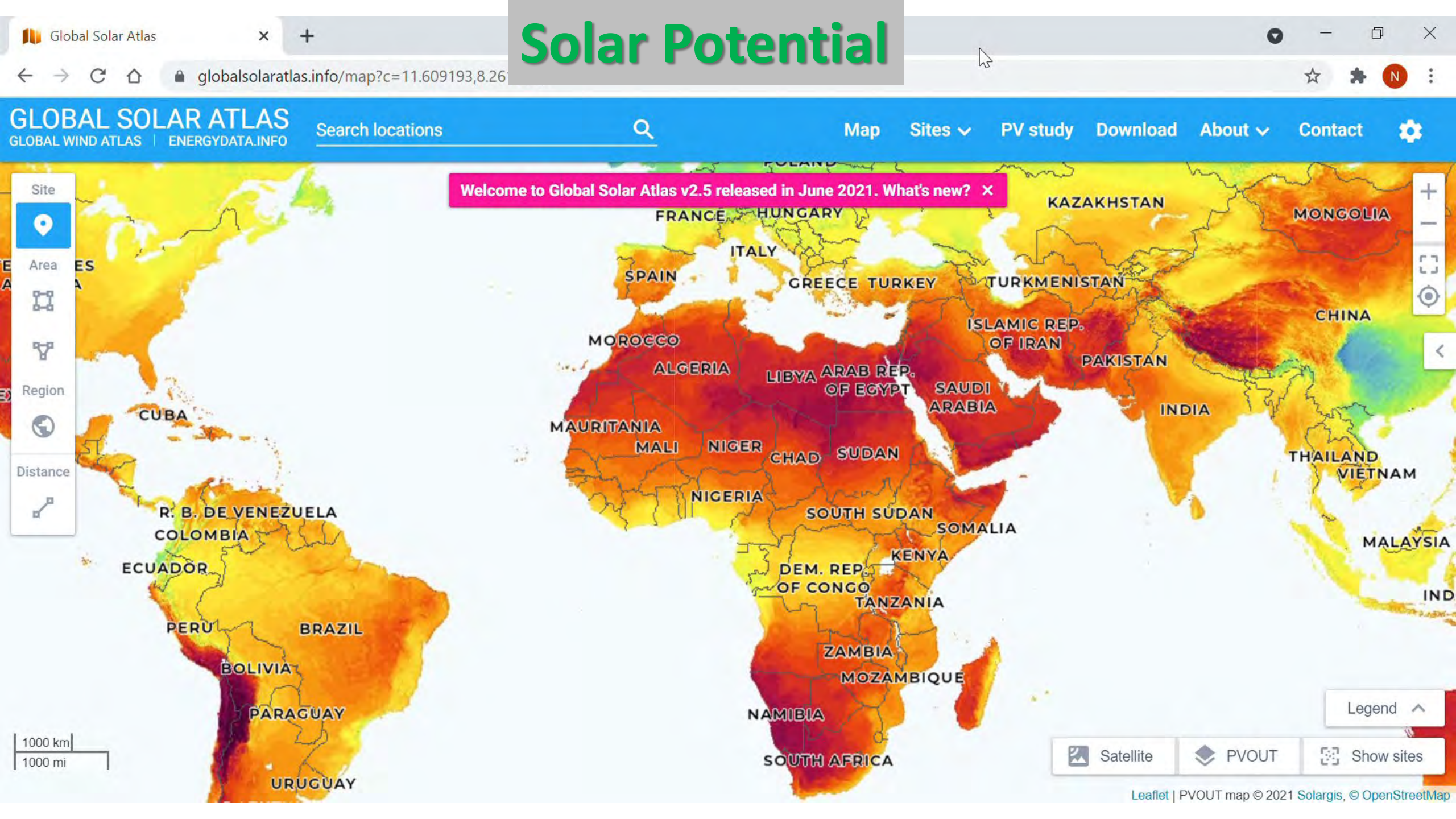
# WAPOR (FAO)


Mashreq Data Portal
FAO Water Productivity
wapor.apps.fao.org/home/WAPOR_2/3?theme=L3_BKA_LCC_D&dim=DEKAD:%255B2019-12-11%252C2019-12-21)
Food and Agriculture Organization of the United Nations
WaPOR
The FAO portal to monitor WAter Productivity through Open access of Remotely sensed derived data
Layers
THEME
Land Cover Classification (Bekaa, Lebanon - Dekad
DEKAD (10-DAYS PERIOD)
20/12/2019
WaPOR 2.1
My WaPOR
Info
Feedback
LEGEND
Land Cover Classification (Bekaa, Lebanor
Tree cover (dense)
Grassland
Bare
Wetland
Artificial
Fallow
Wheat
Irrigated wheat
Maize
Irrigated maize
More options
ANALYSIS
LAYERS
CATALOG
10 km

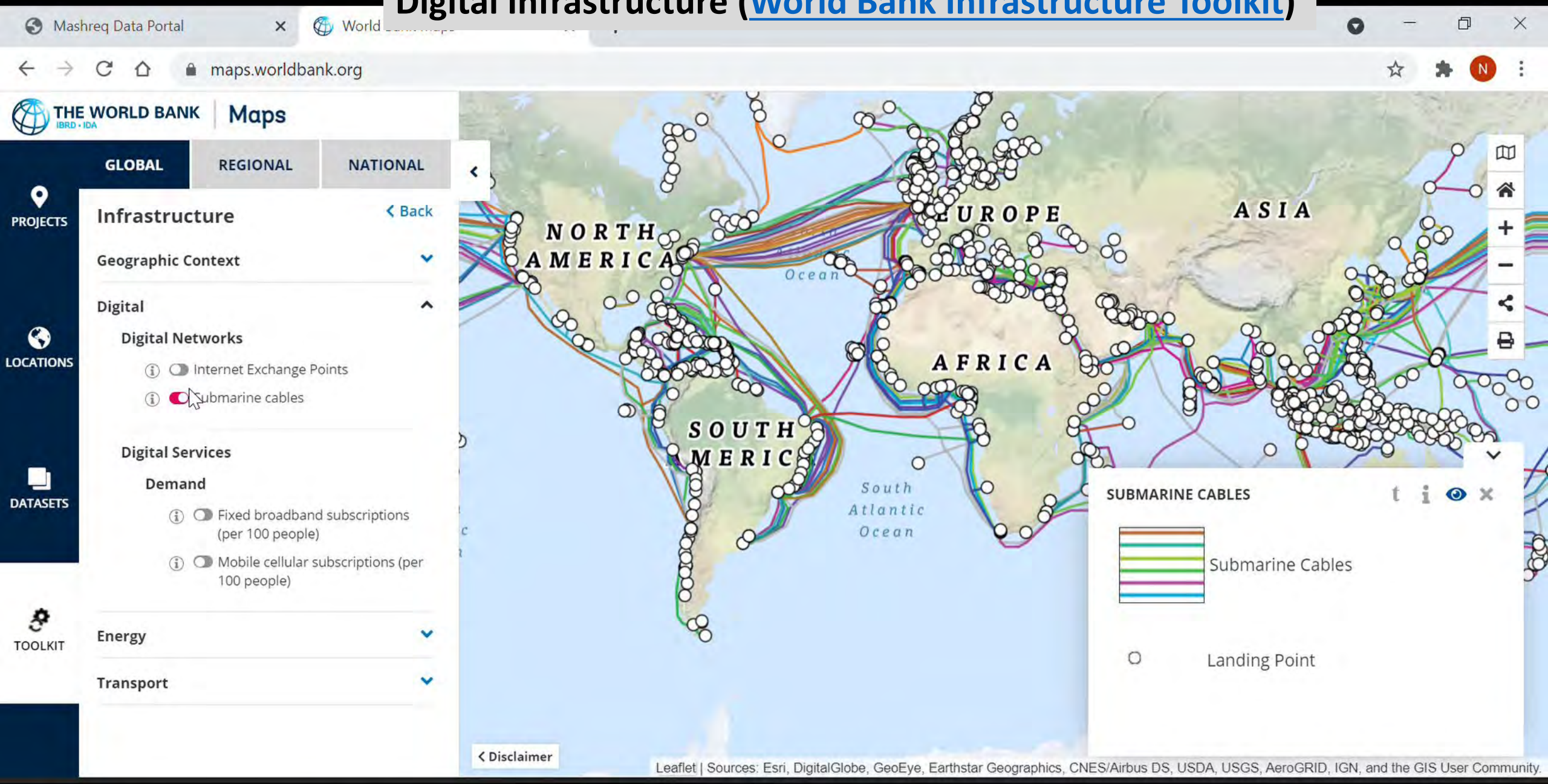
# Power Plants



# Solar Potential



# Digital Infrastructure (World Bank Infrastructure Toolkit)

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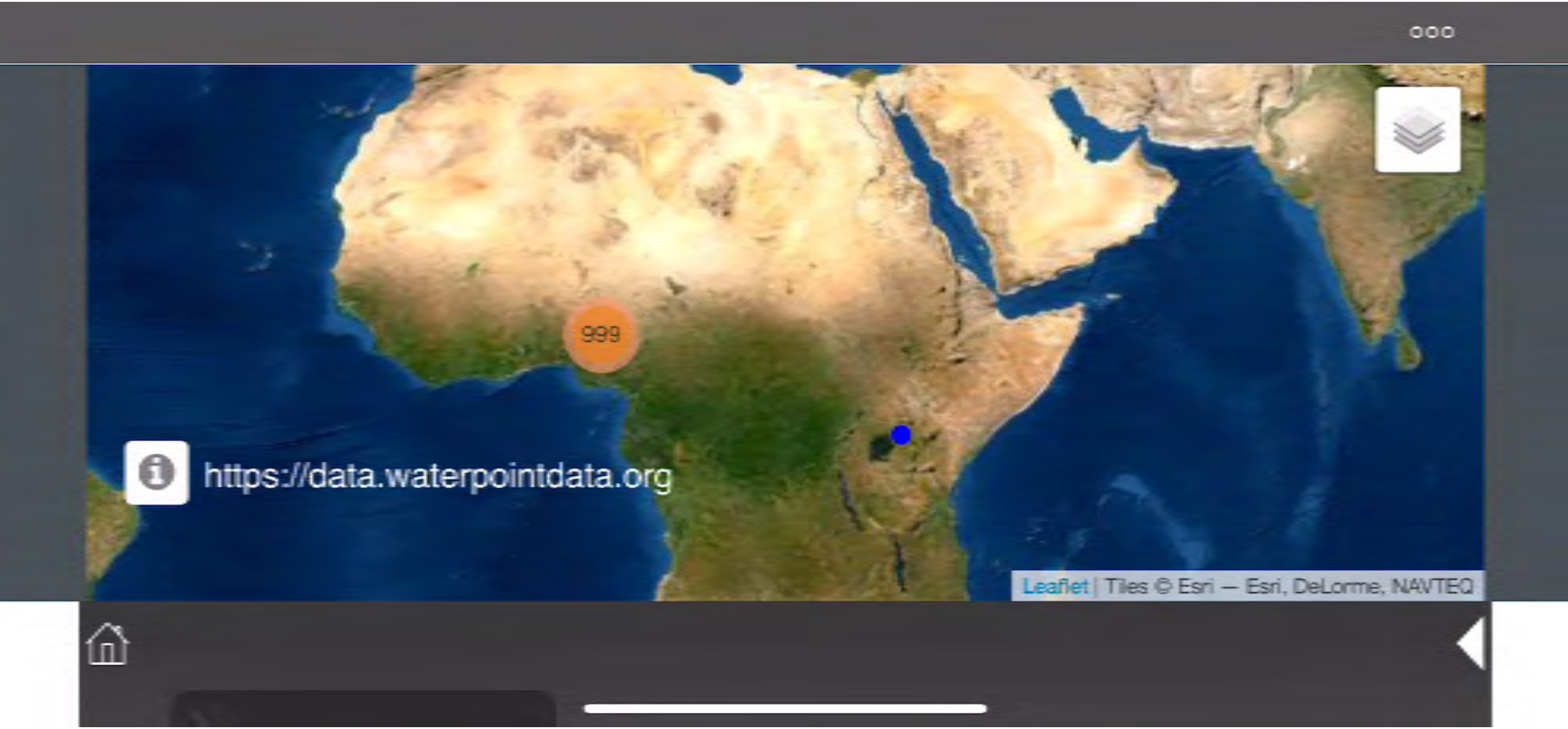
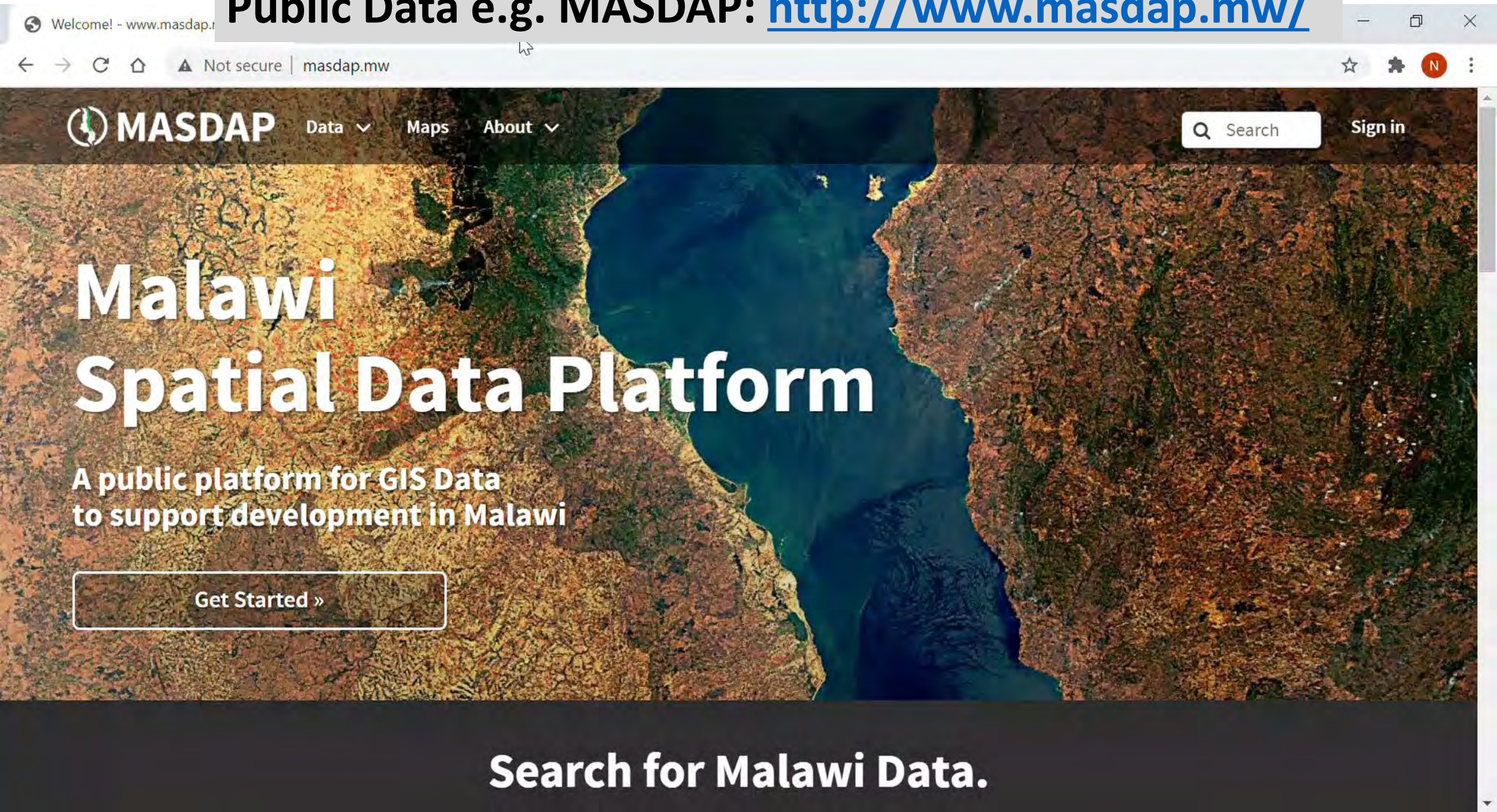
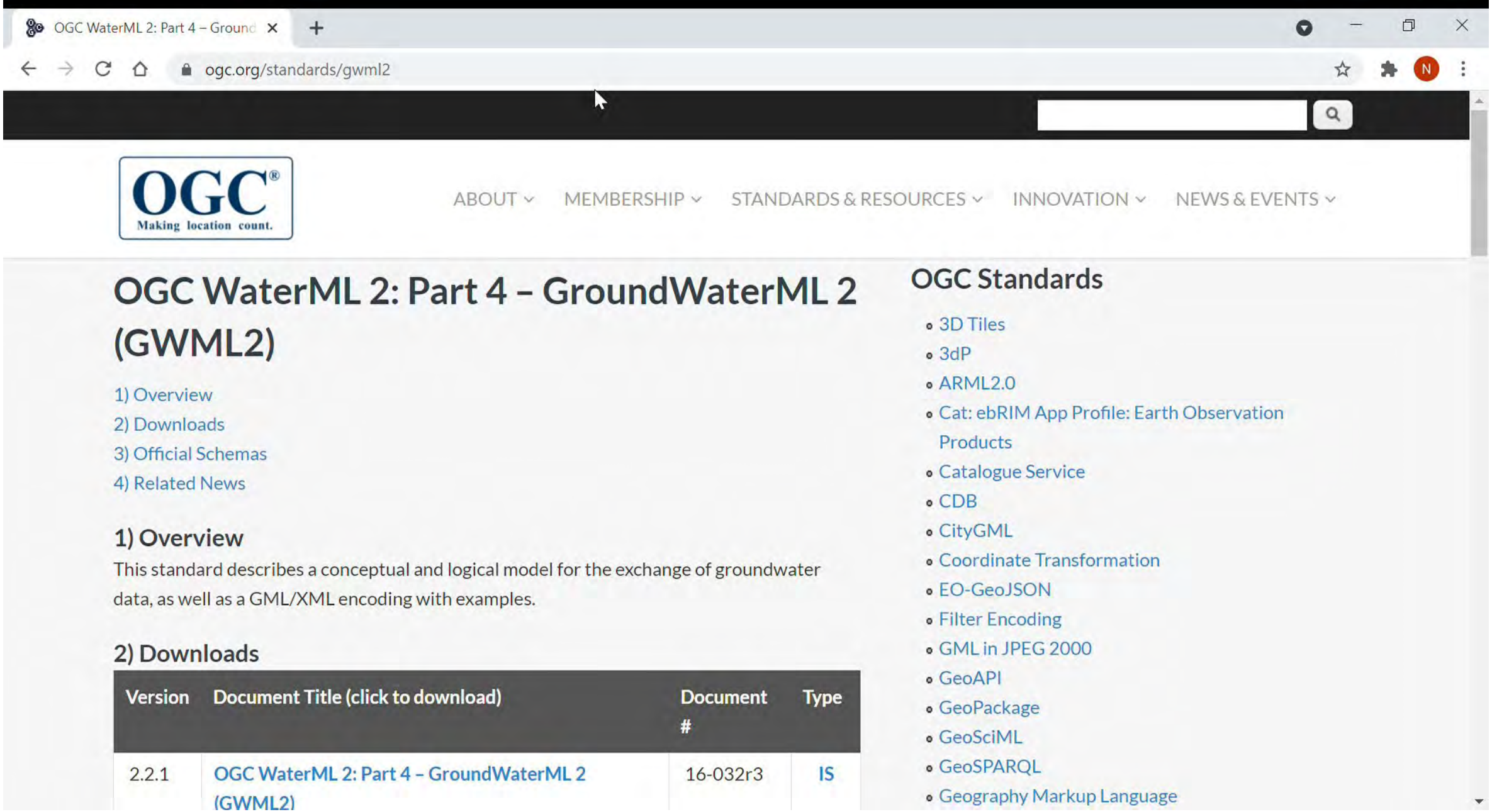
# Data from Water Point Data Exchange in Spatial Agent Mobile App

https://data.waterpointdata.org/



# Public Data e.g. MASDAP: http://www.masdap.mw/

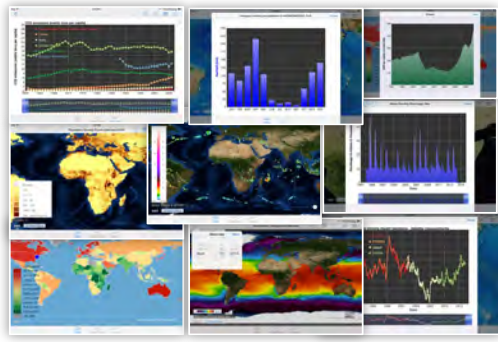




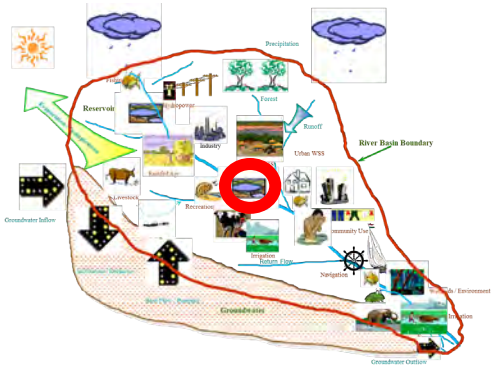

OGC: https://www.ogc.org/
Also see: https://link.springer.com/article/10.1007/s10040-018-1747-9

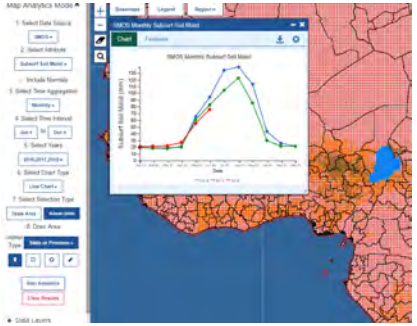
# Illustrative Interactive Dashboards

## Example for Water Infrastructure Operations



**Decisions to be Supported: When to release? How much to release?**





### Climate

- Rainfall in upstream watershed (GPM, in-situ gauges/radar, CHIRPS, …) – current & historical
- Weather forecasts (short-term, seasonal); Storm tracks
- Snowmelt estimates (if relevant)…

### Flows

- Current and historical flows (from in-situ observations, satellite estimates where possible)
- Dam inflow forecasts (e.g. from GEOGLOWS Global Streamflow Forecasting, local forecasts)…

### System Levels

- Current and historical levels of this dam's reservoir as well as other storages in system (e.g. from satellite, in-situ gauges)…

### Downstream

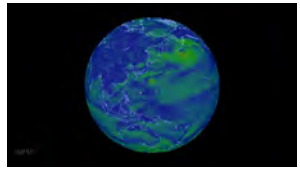
- Irrigation status (crops, crop stage from earth observation and in-situ)
- Soil and sub-surface soil moisture, groundwater (from earth observation and in-situ)…

### Other Data & Analytics

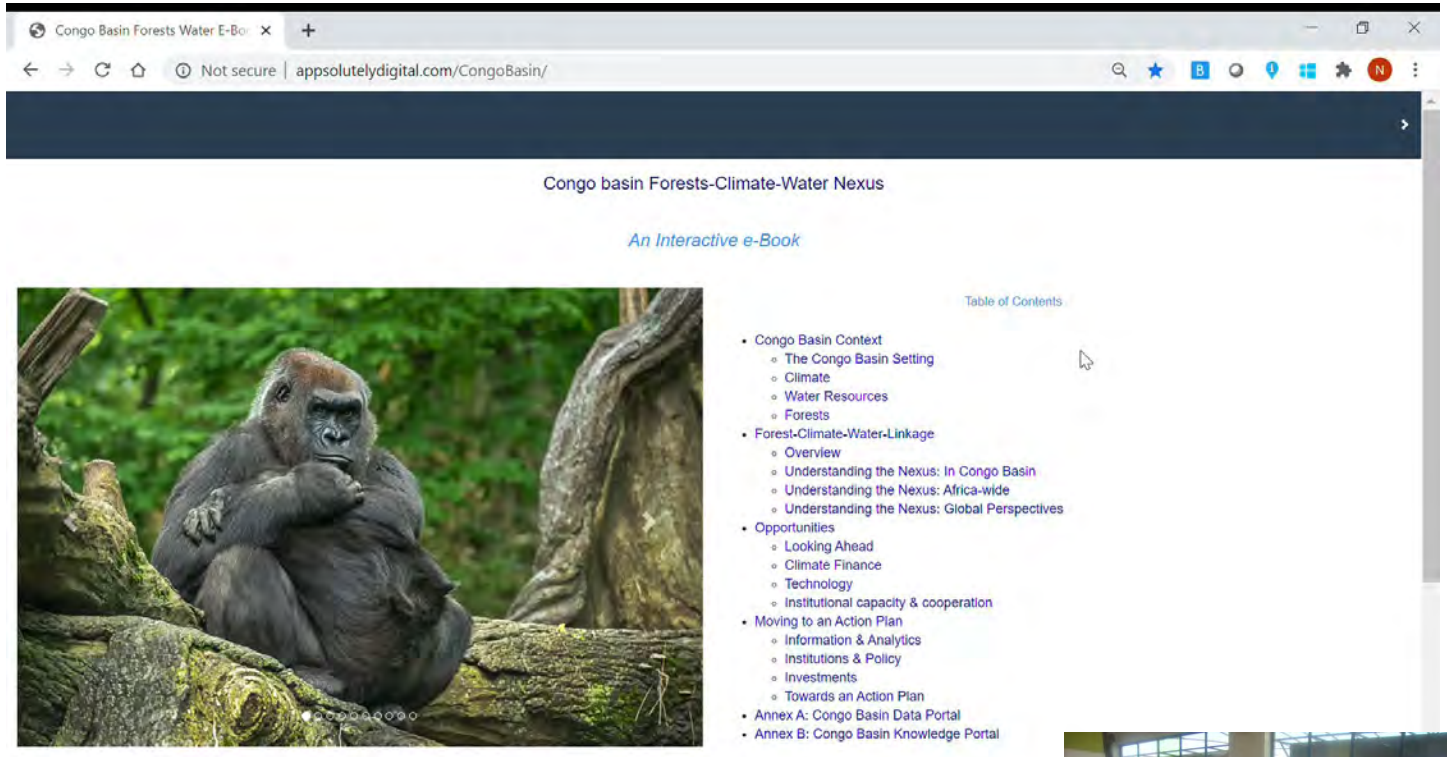
- Inundation forecasts
- Systems water infrastructure needs
- Systems model to explore implications of alternative dam operations
- Hi-resolution Satellite data
- Crowdsourced data

…

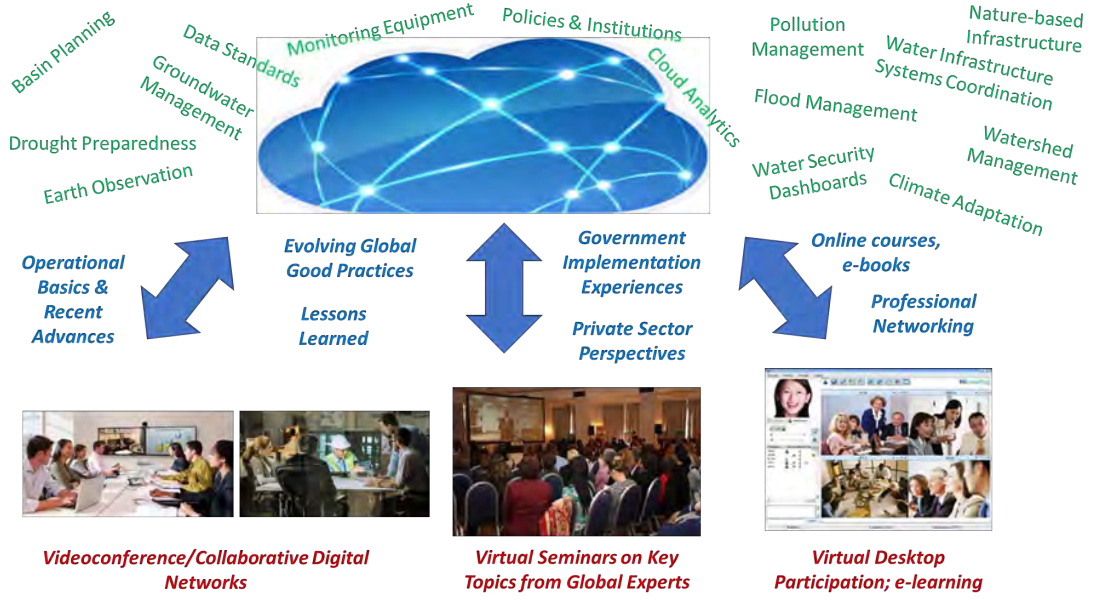
Need to draw upon global and other accessible data and analytic services to make interactive maps, graphs, and analytics for such decision support dashboards that are accessible on portals, apps, e-books, touchscreens, etc.



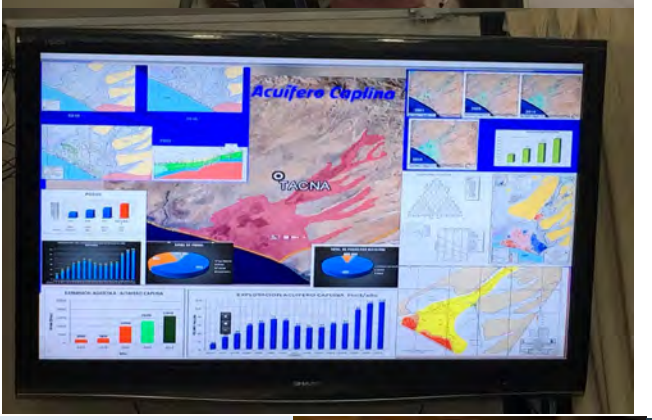
## E-Packaging of Knowledge
(e.g. Interactive E-books/ Storymaps)




## Outreach
(e.g. virtual/online learning, hackathons, Expos)

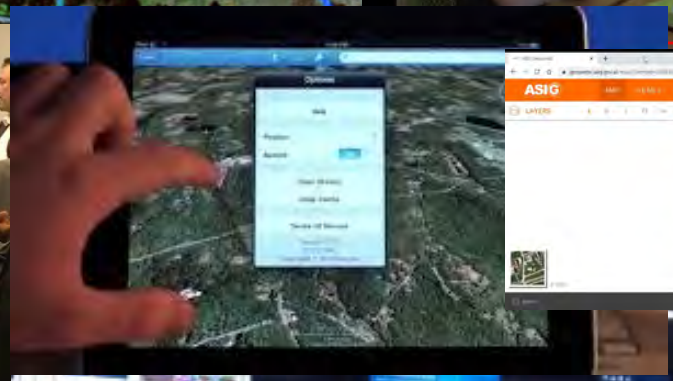


## Large Displays




## TouchScreens

## Physical Interactive Models



## Touch Tables

## VR

## Touch Projectors

# Reimagine Groundwater Management Challenges in a Disruptive Tech Context

## Information

Understanding and monitoring groundwater systems (e.g. aquifers, extraction, recharge, quality)

Analytic insights into specific groundwater links to water cycle and inform longer-term planning and shorter-term operational decision support

## Institutions

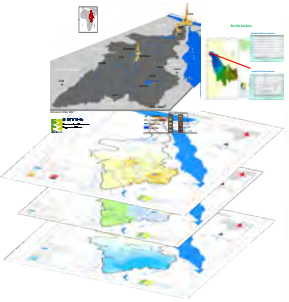
Institutional arrangements to work across spatial and sectoral scales

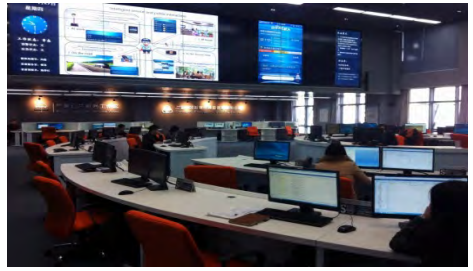
Capacity, policies, and instruments to effectively manage groundwater effectively and sustainably

## Investments

Planning and operation of extraction and recharge investments in a systems context

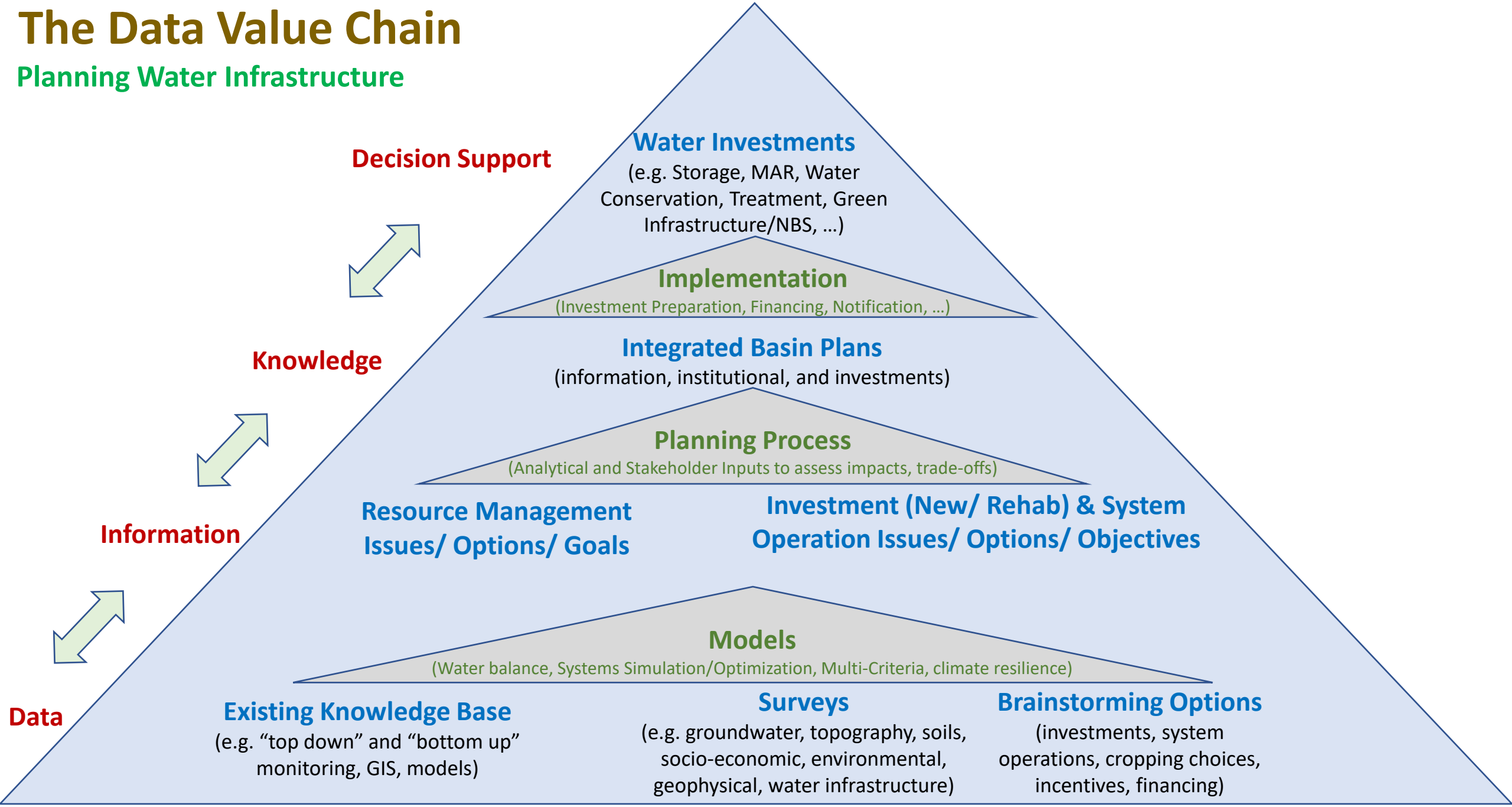
Development and climate scenario- based investment planning considering technical, environmental, social, economic, financial, institutional, and other sustainability aspects





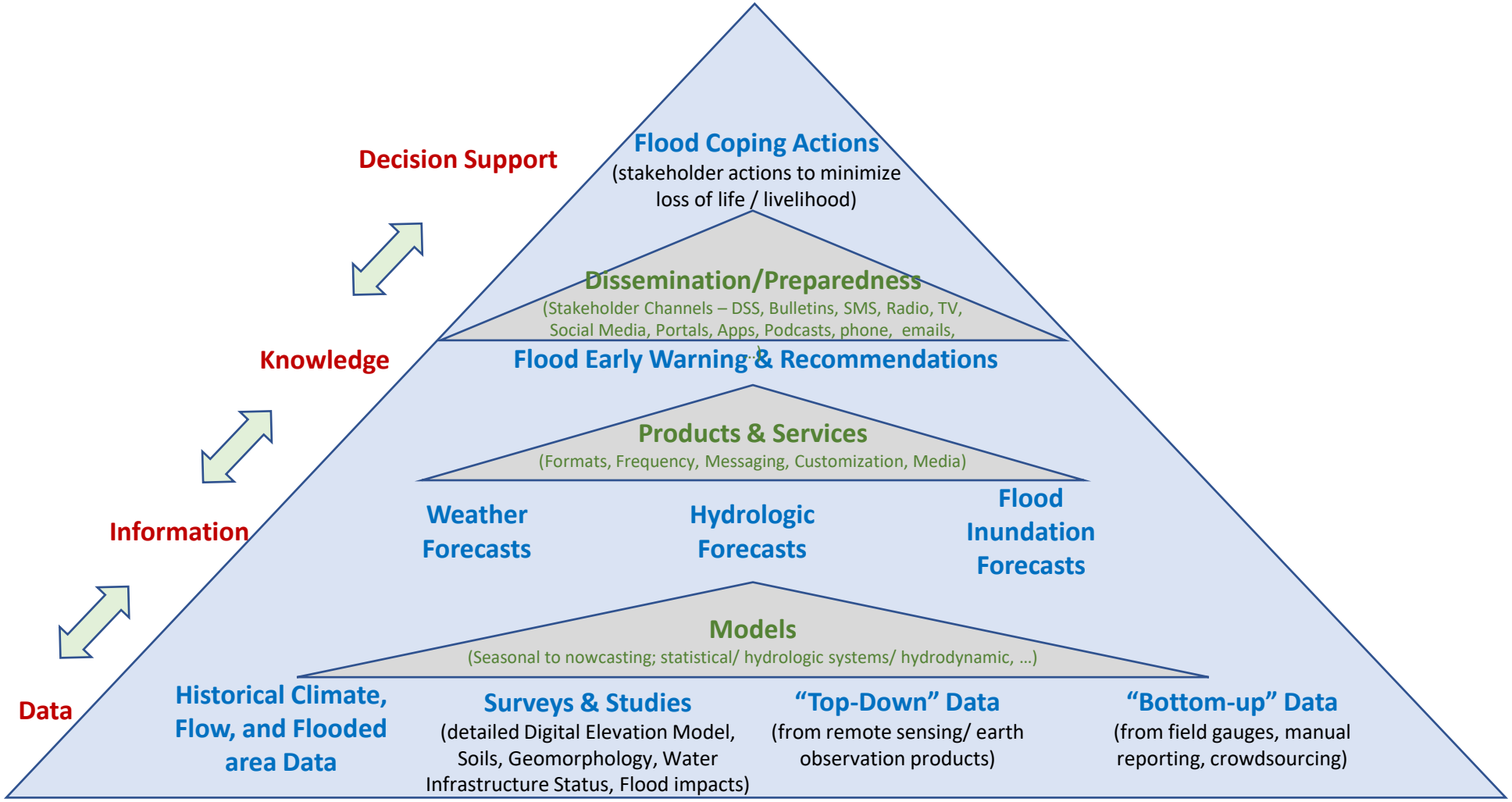
# The Data Value Chain

## Planning Water Infrastructure



# The Data Value Chain

## Example: Deciding on Coping with Floods



# In Summary

- Please explore this growing Mashreq Water Data Portal Ecosystem:
  - Mashreq Water Data Portal
  - Mashreq Water Knowledge Explorer
  - Disruptive Tech in Groundwater E-book

- Please do showcase your data and analytics work!

- **Please** do contribute links to your **public-domain** data, models/scripts, analytics, case studies, knowledge products, videos that are in the public domain!

Disruptive Technology

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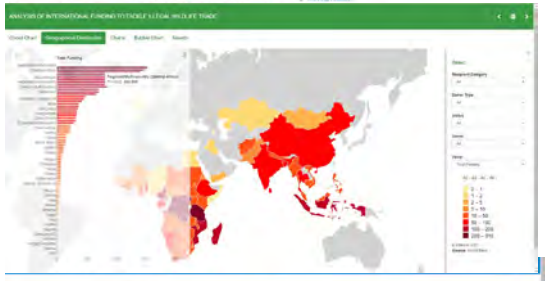
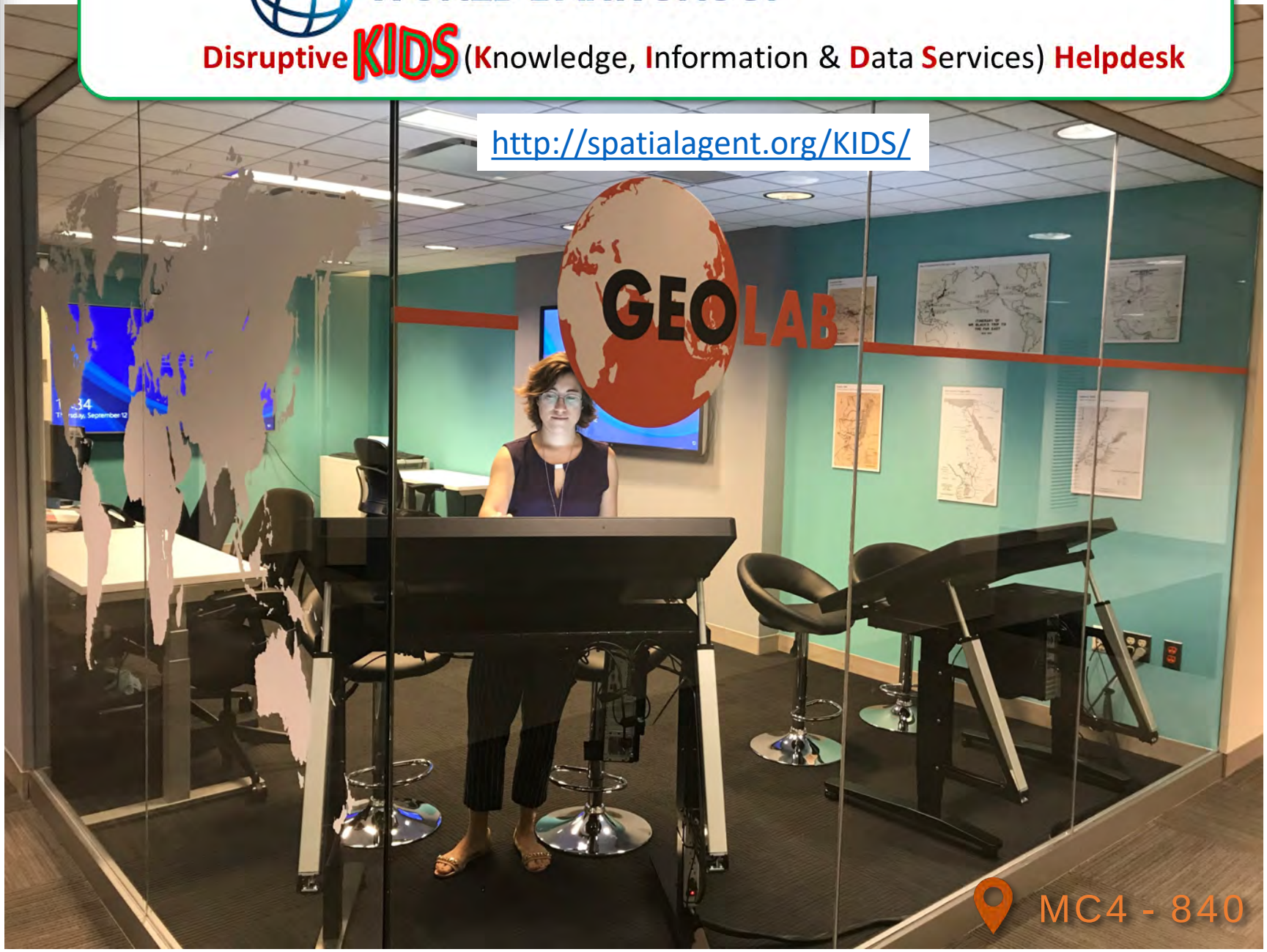
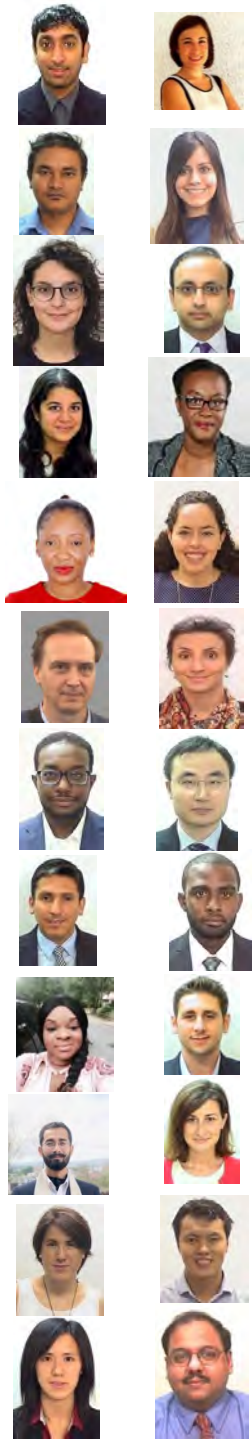
Disruptive KIDS (Knowledge, Information & Data Services) Helpdesk

http://spatialagent.org/KIDS/






MC4 - 840



# Disrupt or Be Disrupted!

# Thanks!

http://spatialagent.org/Mashreq/

**Nagaraja Rao Harshadeep (Harsh)**
Global Lead (Disruptive Technology)
Environment, Natural Resources & Blue Economy Global Practice
The World Bank
1818 H St NW
Washington DC 20433
harsh@worldbank.org

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